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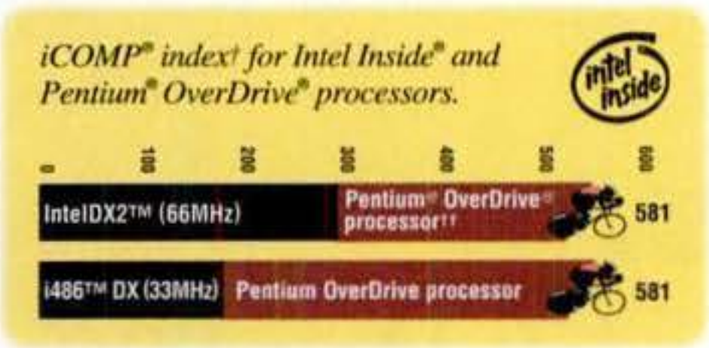

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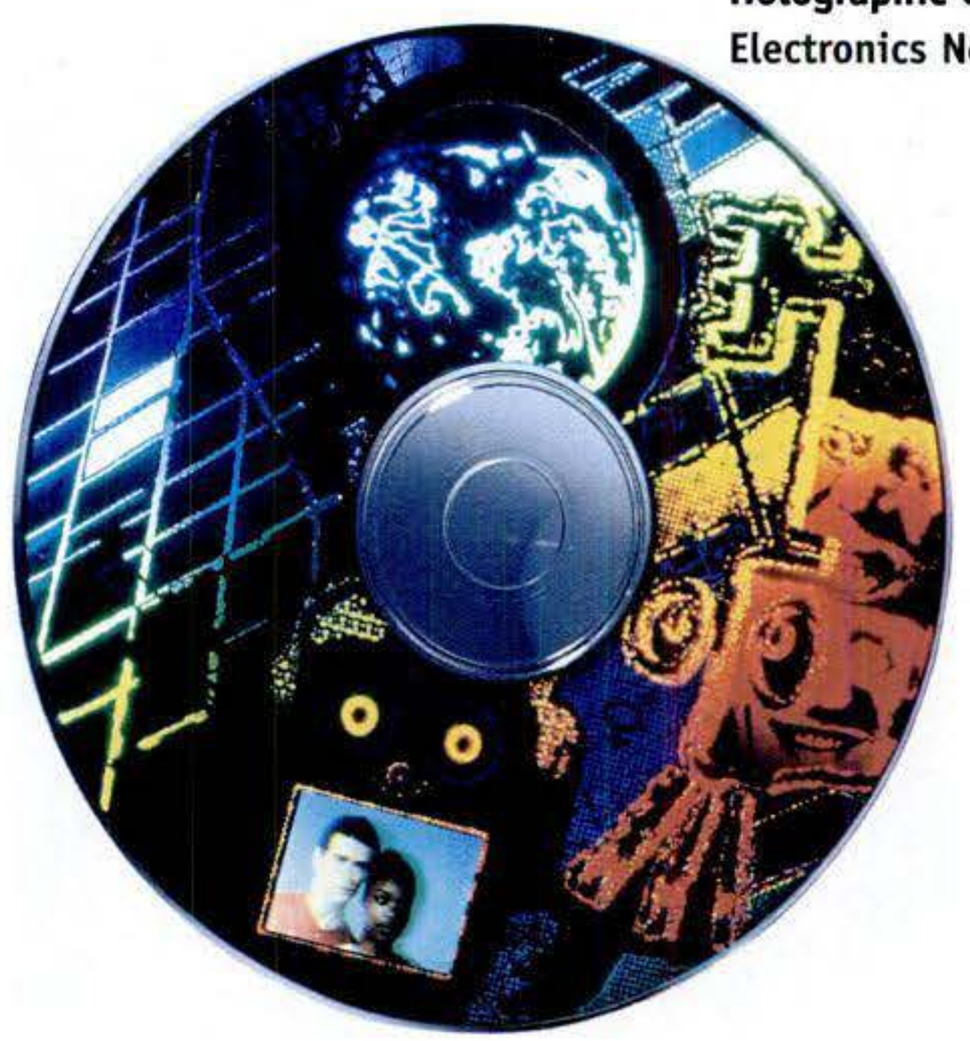

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92 The Spin Doctors The antidote to skids and slides is an electronic stability-control system that makes your car go exactly where you point it with the steering wheel. One-wheel braking is the key, and a journey to the Arctic Circle tests the cure.

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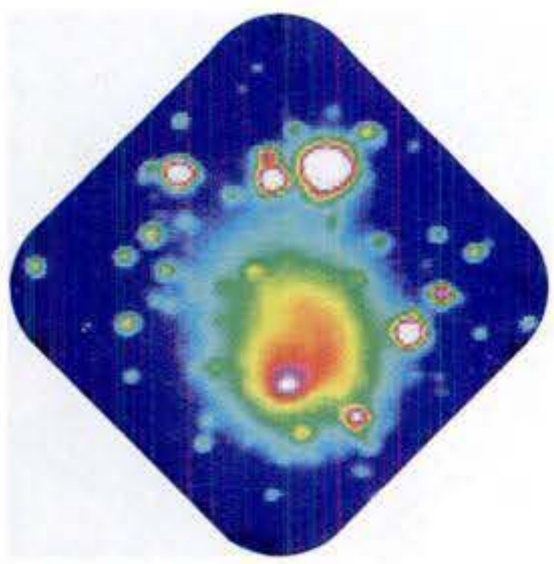

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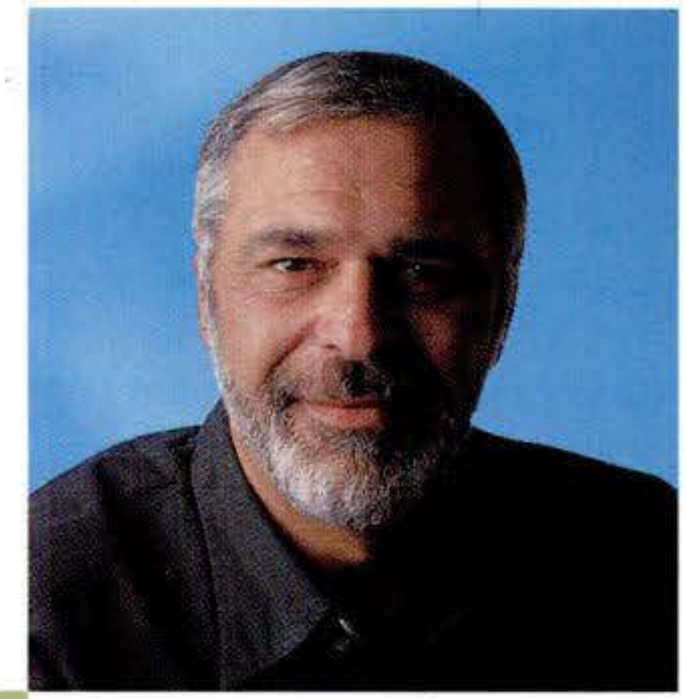
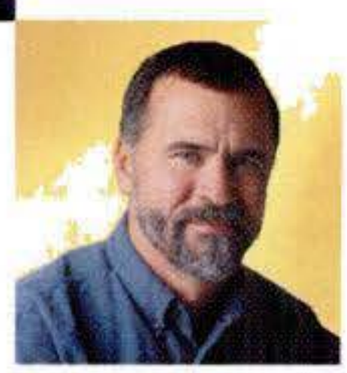
The Best of What's New



WE PROUDLY BRING YOU POPULAR SCIENCE's eighth annual Best of What's New Awards: a report on the progress of the man-made world. You'll also find the Best of What's New on our new World Wide Web site **(http://bwn.popsci.com)**. To pick 1995's top achievements in these fast-paced days of change, the editorial staff debated intently those developments that measure up to a simple yardstick: the ability to make a positive difference in our lives. With pleasure and respect, I present the editorial staff of POPULAR SCIENCE.—*Fred Abatemarco,* **popscied@aol.com**

Left to right, from top row: Teresa Fernandes, Richard Stepler, Cecilia Wessner, Arthur Fisher, Candace Golanski, Mariette DiChristina, John B. Carnett, Kim O'Reilly, William L. Thieriot, Michael Antonoff, Christopher Garcia, Bob Sillery, Marcie Mason, Judith Anne Gunther, Suzanne Kantra Kirschner, Stuart F. Brown, Dawn Stover, Suzanne Watson, Carrie Zeisse, Chris O'Malley, Dennis Normile, Patti Gareri, Cynthia Van Roden, Dan McCosh. Forever a part of this family is recently retired Art Director W. David Houser.



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Testing Discovery

I PROTEST Don Sherman's report about the handling of the Land Rover Discovery in "Masters of Mobility" [Oct.]. Our chassis engineer, Rod Mackenzie, along with noted winter-ice-driving expert Tim O'Neill, accompanied the POPULAR SCIENCE team during vehicle testing at the ITT Proving Ground and the Milan, Michigan, dragway. At no time did we observe any of the kinds of results that would have led Sherman to express the opinions he did, though he did drive the vehicle beyond what our observers felt were reasonable limits. There have been no accidents or injuries that can be attributed to Discovery handling characteristics. The vehicle's overall construction, strength, and crash management capabilities are on a par with passenger car safety standards and are certainly among the best among SUVs.

Bill Baker
Vice President
Corporate Communications
Land Rover North America

Our report on the Land Rover Discovery is based on several driving experiences. The most conclusive were two POPULAR SCIENCE test sessions—dry pavement in January 1995 and snow-road tests the following month. We stand by our assessments of the vehicle's behavior and the methodology of our testing. The whole point of testing vehicles in aggressive handling maneuvers—such as a slalom or lane-change test—is to study and observe their susceptibility to loss of control.

Hurricane Formation

YOU GOT some things wrong in "Hurricane Alert!" [Sept.]: Hurricanes are not caused by temperature and pressure differences between clouds and water. In fact, such variations are always present. What lets a hurricane form: sufficiently high water temperatures; sufficiently low vertical wind shear; and low-level vorticity, or circulation, which is caused in the Atlantic Ocean by disturbances propagating westward from the African continent. Contrary to your story, also, nothing is sucked up into the eye of the hurricane; air within the eye generally sinks. The strongest winds and updrafts are instead found within the eye-wall, the wall of clouds surrounding the eye. And Earth's rotation near the equator does not enhance hurricane spinning motion.

Jim Kossin
Dept. of Atmospheric Sciences
Colorado State University
Fort Collins, Colo.

Plodding Passing

GIVEN THE listed acceleration times for the 1996 Porsche Turbo [Automotive Newsfront, Oct.]—0 to 60 in 3.9 seconds, and 30 to 50 in 9.6 seconds—does Porsche recommend coming to a dead stop before passing traffic? What a rush!

John Clayton Geiger
via fax

Cars with a manual transmission are left in top gear for the 30-to-50 car-passing test. With downshifting, that time would be reduced drastically.

Say What?

REGARDING THAT new hearing tester for newborns [What's New, Oct.]: Even if they let the kids listen to music, carrying the baby around in a suitcase seems a little too casual—and hard on the arms.

Roy Salkus
Vancouver, B.C., Canada

EDITORS NOTE: *The web joists pictured with "Engineered Lumber from the Top Down" on page 53 of the October issue should have been shown rotated 90 degrees to the left.*

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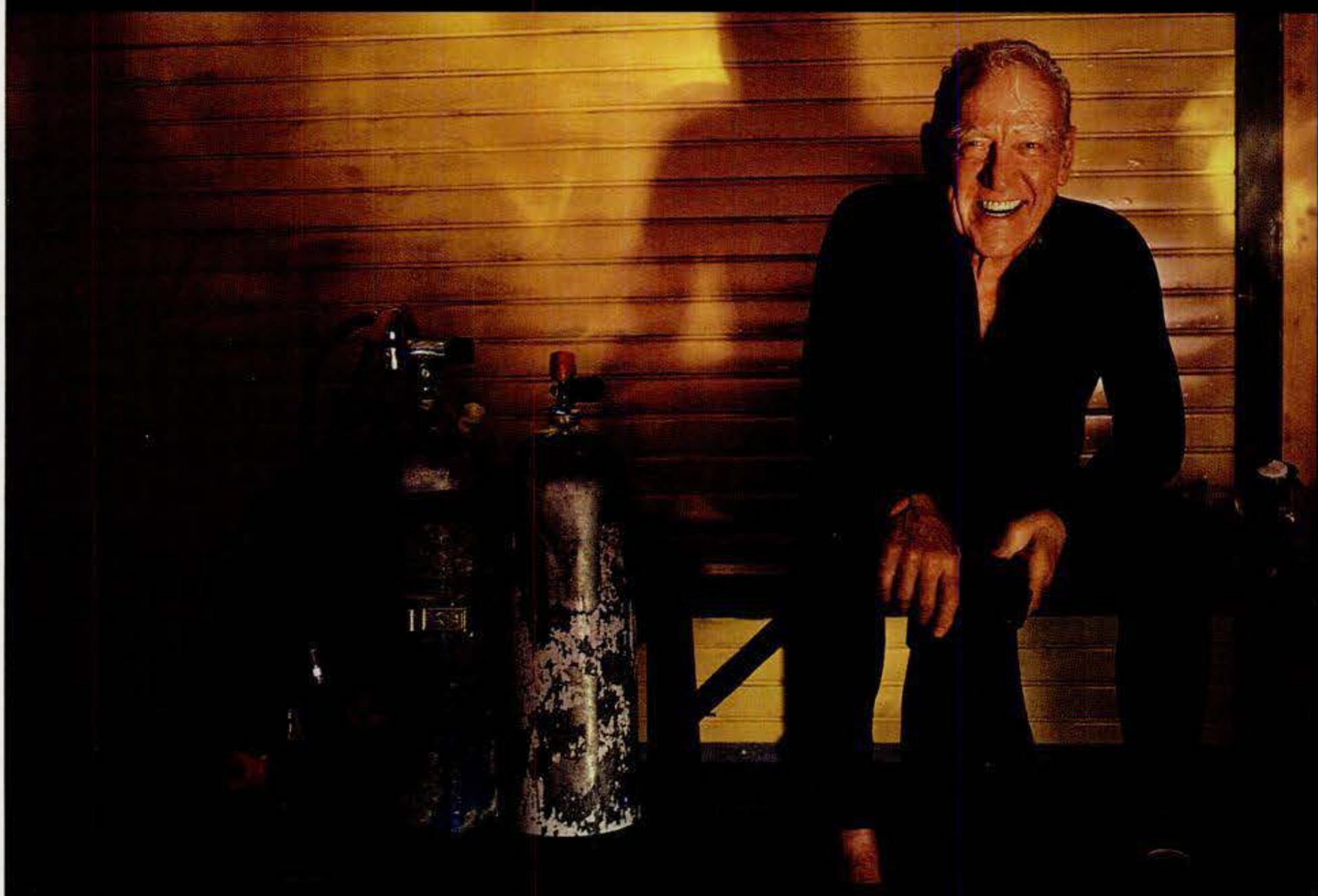

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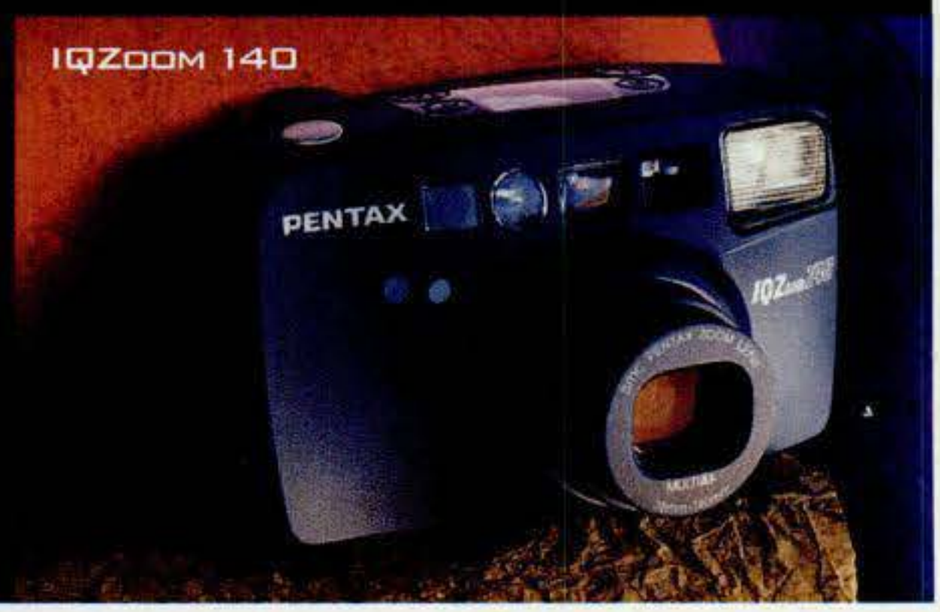

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in balance

DOING WHAT'S RIGHT FOR NATURAL RESOURCES

America Turns out for PLAD

On Sept. 30, 5,000 Americans paid a bill. Call it an installment. With a backlog of $4 billion in repairs needed on our 700 million acres of public lands, 5,000 volunteers rolled up their sleeves, put their feet to shovels and their hands to rakes to rebuild trails, lakes, streams, shorelines, wetlands, and wildlife habitats at 20 sites across the country.

From Anchorage to New York, from wildlife watering holes in Arizona to Connecticut's Appalachian Trail, Public Lands Appreciation Day (PLAD) showed what Americans can do to restore our nation's natural resources. In doing so, they've made the outdoors more enjoyable and more accessible for all of us.

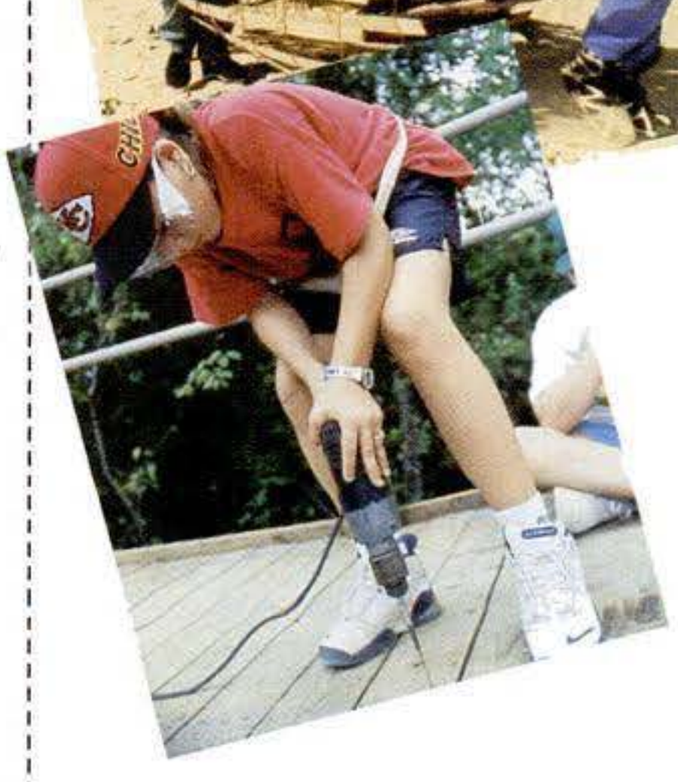
Here's a sampling of what PLAD accomplished:

At **Canyon Lake** near San Antonio, Texas, 570 volunteers turned out to build hiking trails, a handicap-access path, and a fishing platform; plant 325 trees; build 26 birdhouses; and create a 10-acre wetland and wildlife observation deck.

Despite four inches of early snow, 170 volunteers centered in **Winter Park,** Colo., cleared two miles of trail on the Continental Divide and rehabbed old trails into wetlands.

At **Gateway National Recreation Area** in Queens, N.Y., 270 volunteers showed up to build snow fencing, plant beach grasses, paint buildings, and generally give the site a long needed spruce-up.

In Kentucky, 650 volunteers widened trails; erected benches, birdhouses, and trail signs; and enjoyed a hog roast at **Lake Cumberland** near Russell Springs. One volunteer came from New Mexico; another came by motorcycle from Michigan.



It's all in a PLAD day's work at (top center) Gateway National Recreation Area, N.Y. and (above and left) Canyon Lake, Texas.

An energetic crowd of 450 volunteers showed up at **Buffumville Lake** near Oxford, Mass., to tackle a whopping 29 projects, from trail restoration to erosion control, fence installation, and tree planting.

At the **Empire-Cienega Resource Conservation Area** near Tucson, Ariz., 410 volunteers erected 13 miles of fencing, created three wildlife watering holes, and reinforced soil erosion areas. Said Bureau of Land Management spokesman Jesse Juen, repeating what many organizers at other PLAD events had to say: "This event galvanized the community to create a better home for wildlife, as well as for everyone who loves the outdoors. We've had so much volunteer interest and such great support from the local business community that we're committed to do it again!"

For the thousands of PLAD volunteers, and for the caretakers of our public lands—the U.S. Forest Service, U.S. Army Corps of Engineers, National Park Service, U.S. Fish & Wildlife Service, and the Bureau of Land Management—who joined with Times Mirror Magazines, McDonald's and Chevrolet/Geo Environmental to create Public Lands Appreciation Day, it was a day to remember. And a day to repeat.

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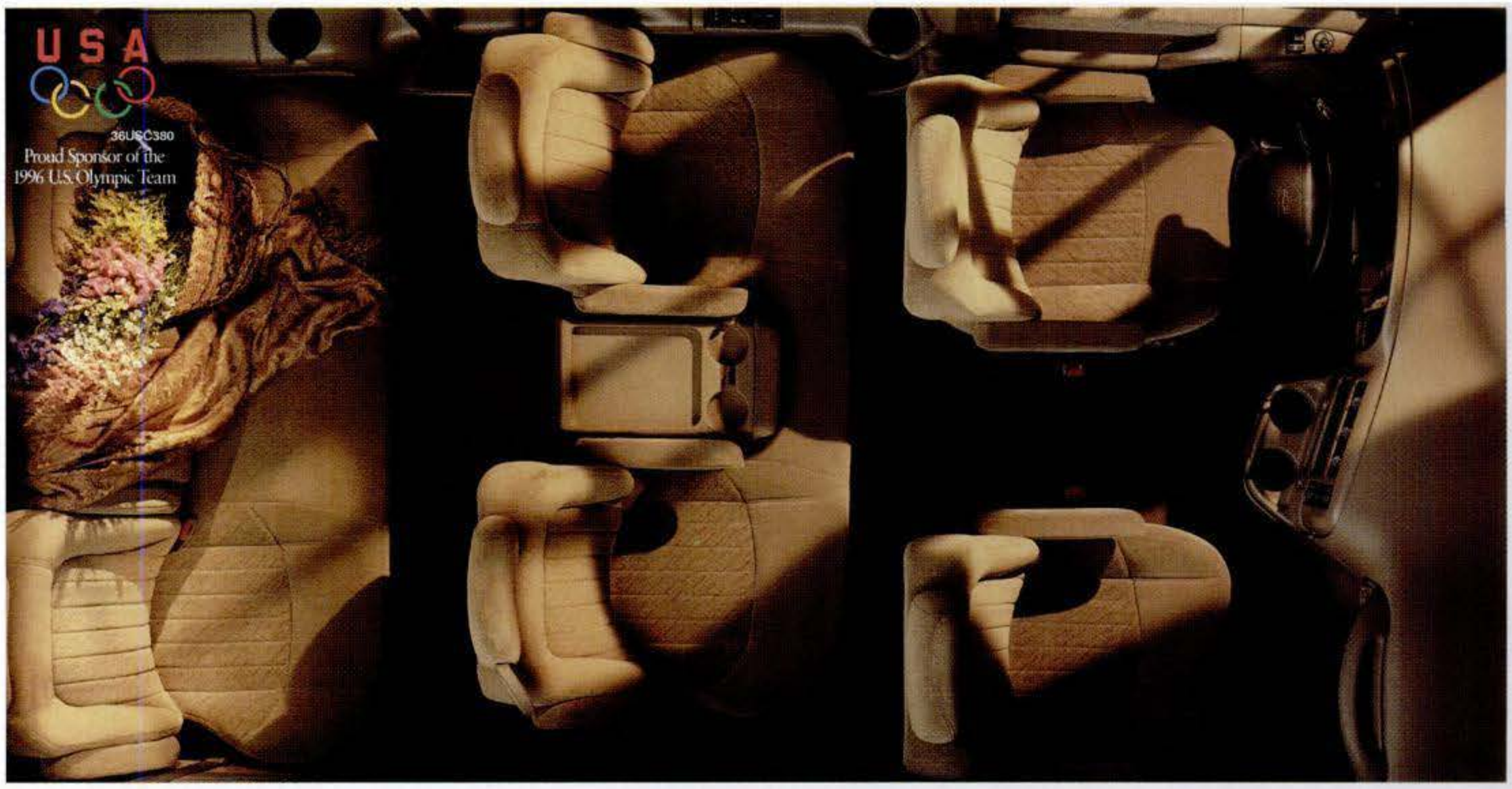

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NEWSFRONTS

AUTOMOTIVE

EDITED BY RICHARD STEPLER

MOTORSPORTS

The Dodge Viper GTS-R: Designed for Racing

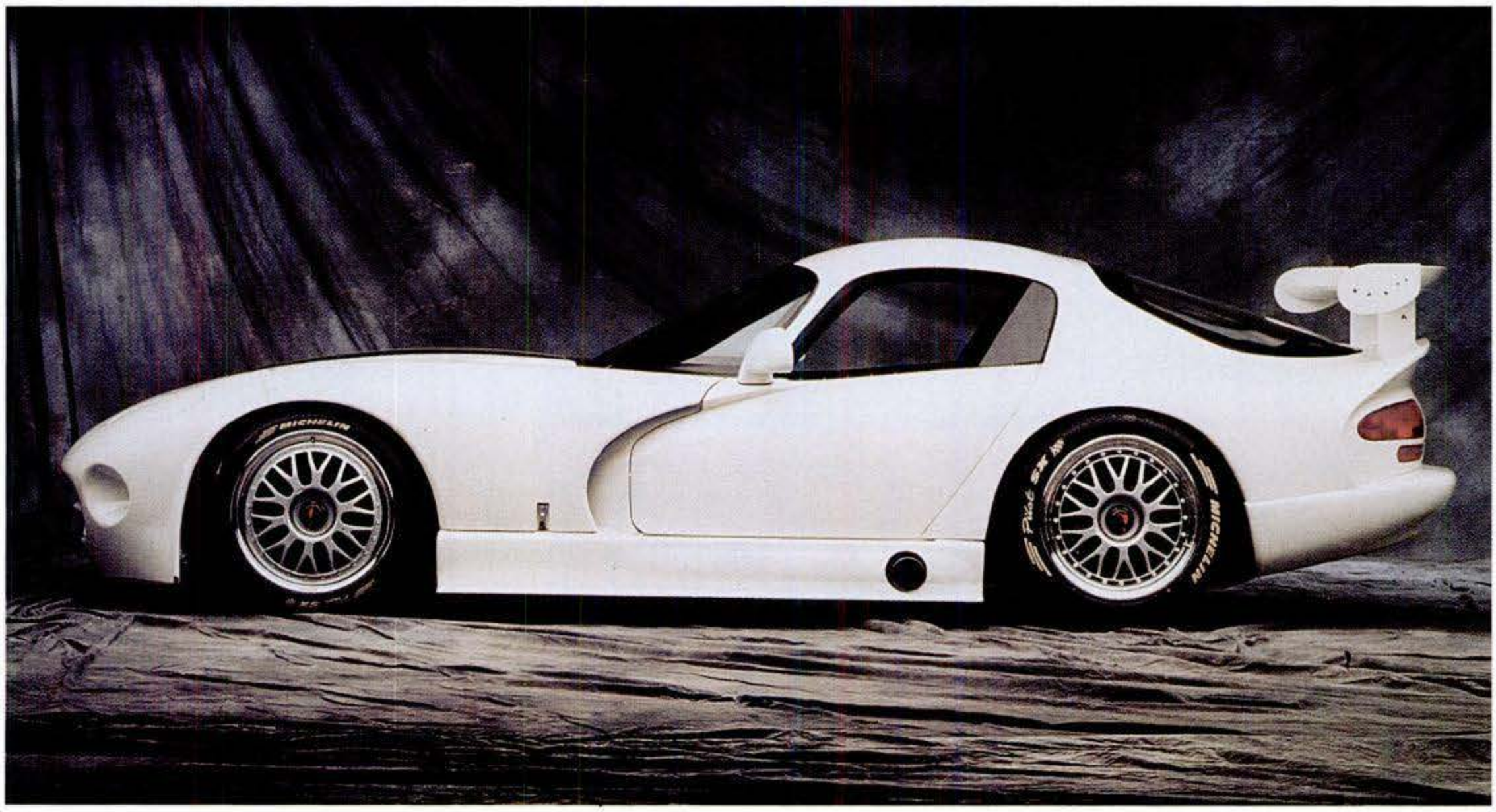
THE CLASSIC British definition of a sports car is "a two-seater that can, in a pinch, be raced." The original Viper roadster certainly measured up to that, inspiring, among other endeavors, a Le Mans 24-hour racing effort. However, now there's a Viper that's much better suited to on-track enterprises. The new limited edition GTS-R is designed strictly for racing.

While this car looks very much like the new Viper GTS coupe with a wing grafted onto its rear deck, the similarities don't go much beyond appearance and general dimensions—not even skin deep, in fact. That's because the skin is largely fabricated in carbon fiber. The exotic exterior covers a much modified Viper frame and race-worthy suspension pieces. In addition to extensive strengthening and revised engine location, the GTS-R employs an integrated chrome-moly roll cage, yielding a level of overall chassis stiffness that's roughly twice what the standard Viper offers. Which puts it on a par with a railroad trestle.

Power is abundant. The GTS-R's V10 engine comes in three versions. "Standard" is rated at 525 horsepower and 650 foot-pounds of torque—torque on the order of an aircraft carrier steam catapult. Two higher-output upgrades produce top-end horsepower of 650- and 700-plus. The V10's massive output finds its way to the rear wheels via a carbon fiber clutch and a six-speed transmission.

You'll need a little more than the $50,000 or so that would buy you a regular 1996 Viper coupe. But even so, Chrysler wants to project an appearance of pricing restraint. "We haven't finalized the price yet," says Dodge division manager Marty Levine. "But we think it's important to stay under the $200,000 threshold."

Does that still seem a little steep? Consider then that the McLaren F1, the winner of the 1995 Le Mans 24-Hour Classic, starts at about $450,000.—*Tony Swan*



The Dodge Viper GTS-R goes to the races on 18-inch racing slicks developed by Michelin. The coupe's top speed is estimated at 200-plus mph.

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1996 MODELS

Off-Road Wagon

SPORT-UTILITY vehicles have the drivetrain hardware needed to traverse challenging terrain, yet most owners rarely depart from the highway. With its rugged 1996 Legacy Outback, Subaru has another type of driver in mind: those who travel through rough country and severe weather but aren't interested in the rock-and-roll handling and poor fuel economy of a sport utility.

The Outback is an all-wheel-drive Legacy station wagon equipped with wider tires, strengthened chassis and suspension components, and a number of other modifications geared to its off-pavement mission. Designers hiked the ride height up to achieve 7.3 inches of ground clearance—more than a Ford Explorer's—and raised the roof to add two inches of headroom and cargo space. Suspension travel was slightly reduced and spring rates were softened to maintain comfort and control on rough ground.

The Legacy Outback and the standard Legacy wagon and sedan are now available with a 2.5-liter, 155-horsepower version of Subaru's familiar four-cylinder "pancake" motor. Along with the added power comes a four-speed automatic transmission. Pricing of the Subaru Outback starts at $22,000 for the manual transmission with the base 2.2-liter engine, and $23,000 for the four-speed automatic with 2.5-liter engine.—*Stuart F. Brown*

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TRANSMISSIONS

Auto-Shift into Neutral

IN A CAR equipped with an automatic transmission, you normally apply the brake to prevent creep at red lights. But the new Opel Vectra's transmission shifts electronically from drive to neutral when you apply the brake pedal at a stop light. Result: Fuel consumption is cut 3 percent in city traffic. The feature also reduces engine vibration. Release the brake and you're back in drive, ready to take off when you press the accelerator.

Neutral auto-selection is a world-first feature of the AF20 four-speed automatic transmission built by GM in France. It's also available on the Vauxhall Vectra.—*David Scott*

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PREVIEW DRIVE

Split Personality

ATTENTION ALL generation-X shoppers: Your car is ready. Suzuki has introduced a cute variation of its Sidekick mini sport utility called, appropriately, the X-90. Underneath, the X-90 is a Sidekick with wider wheel tracks, 95-horsepower engine, and standard antilock brakes. Both two- and four-wheel drive are offered; an automatic transmission is available with the latter.

To give this carryover hardware a fresh lease on life, Suzuki has invented a new class of coachwork best described as

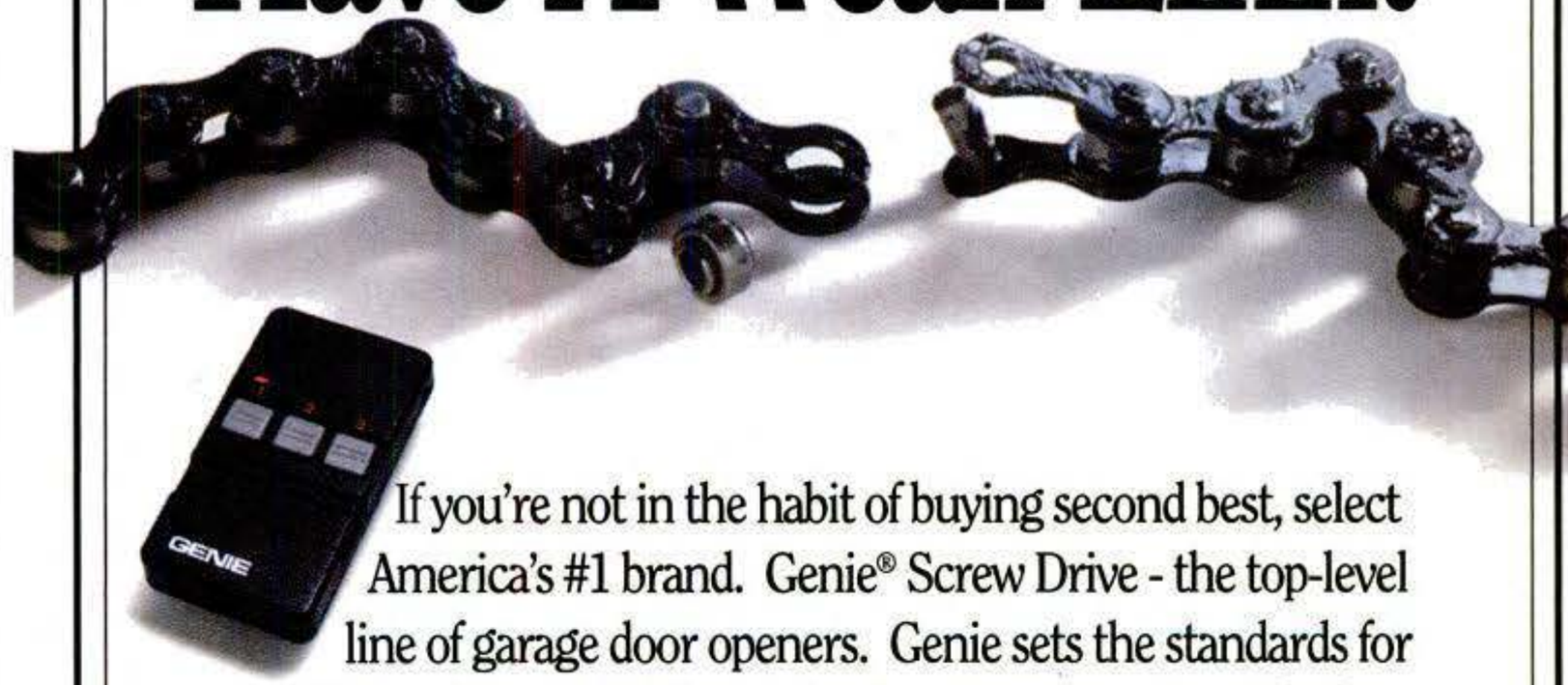
Suzuki X-90: a shift to entry-level chic.

entry-level chic. Contemporary fender curves, a pair of lift-off glass skylights, and a notchback roofline shift the emphasis from sport utility toward sports car.

With space for two passengers plus two bags of groceries in the trunk, the X-90 is functionally the polar opposite of the minivan. In other words, there's no room onboard for a care in the world.

Driving the X-90 up the foothills of Washington state's Cascade Range revealed that this Suzuki isn't short of spunk, whether there's pavement underfoot or not. A luxurious level of standard equipment includes dual airbags and power accessories galore. Prices for the sport utility with a split personality range between $13,500 and $15,950.—*Don Sherman*

Does Your Garage Door Opener Have A Weak Link?



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Ocean Planet tells this story in a unique way. As a proud sponsor, Motorola invites you to experience this exciting new view of our world. Ocean Planet is now at the Smithsonian's National Museum of Natural History in Washington, D.C. and will be traveling to cities across the U.S.

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SCIENCE & TECHNOLOGY

EDITED BY DAWN STOVER

THE OCEANS

Divers' Delight

ACCESS TO technology once available only to military divers could revolutionize the sport of recreational diving, enjoyed by three million Americans. Reductions in the cost of electronic components have enabled at least six companies to develop consumer versions of devices called rebreathers, which allow divers to stay underwater much longer than with scuba gear.

When a diver wearing scuba gear inhales, his lungs absorb only about four percent of the gas in each breath. The other 96 percent is exhaled and released into the water. But with a rebreather, the exhaled gas is recycled. It first passes through a chemical absorbent, usually soda lime, that removes exhaled carbon dioxide. The gas then enters a breathing bag worn on the back or chest. Sensors in the bag determine how much gas must be added to restore the proper mixture. The simplest rebreathers maintain a predetermined mixture of gases, while more advanced models optimize the gas blend for different depths.

The rebreather was first conceived of in the 17th century and has been used by combat divers since World War II. But military rebreathers—made from expensive nonmagnetic materials—typically cost upward of $30,000, while consumer models now sell for as little as $5,000.

Rebreathers enable divers to stay underwater three to 10 times longer than with scuba gear. That appeals to divers exploring caves and shipwrecks. And as Navy divers know, rebreathers are stealthy. They make no noise or bubbles, so scientists and photographers can swim up to fish without spooking them.

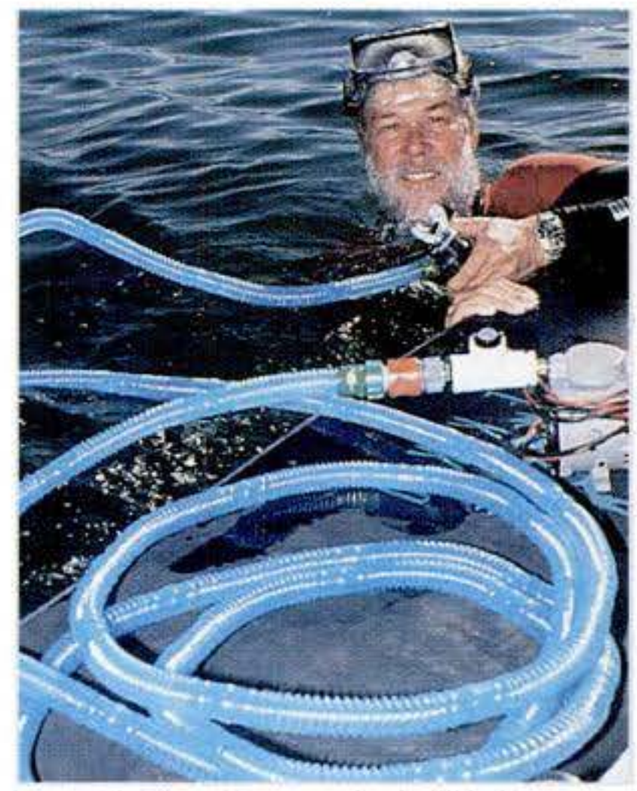
However, rebreathers are "inherently more dangerous" than scuba gear, warns Michael Menduno, editor of the diving journal *aquaCorps*. Companies selling the machines require that divers take a 4-to-7-day training course.—*D.S.*

BRET GILLIAM

UWATEC Dräger's Atlantis 1 rebreather weighs 28 pounds and enables divers to swim soundlessly.

Boater's Helper

KEN ABBOTT/UNIVERSITY OF COLORADO



Inventor Igor Gamow tests the Pressurized Snorkel, handy for cleaning boats.

A NEW DEVICE called the Pressurized Snorkel enables divers to stay up to 10 feet underwater for several hours at a time, offering an alternative to expensive scuba gear for shallow diving.

Using a mouthpiece similar to a scuba regulator, the diver draws air through a flexible plastic hose. A small battery-powered compressor clamped to a boat or dock pumps air into the hose. (Even at depths of just a few feet, the water pressure makes it impossible for a diver to expand his lungs enough to draw a breath without help from a compressor.) Key to the device is a valve that allows air to flow to the mouthpiece only when the diver inhales.

Invented by chemical engineering professor Igor Gamow and research associate Dana Ruehlman at the University of Colorado in Boulder, the Pressurized Snorkel will be sold by the nearby Rocky Mountain Diving Center for $599—about half the cost of good scuba gear. Boat owners could find the snorkel useful for cleaning hulls, clearing debris from propellers, or making repairs. It could also be used to clean swimming pools or for recreation.—*D.S.*

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AVIATION

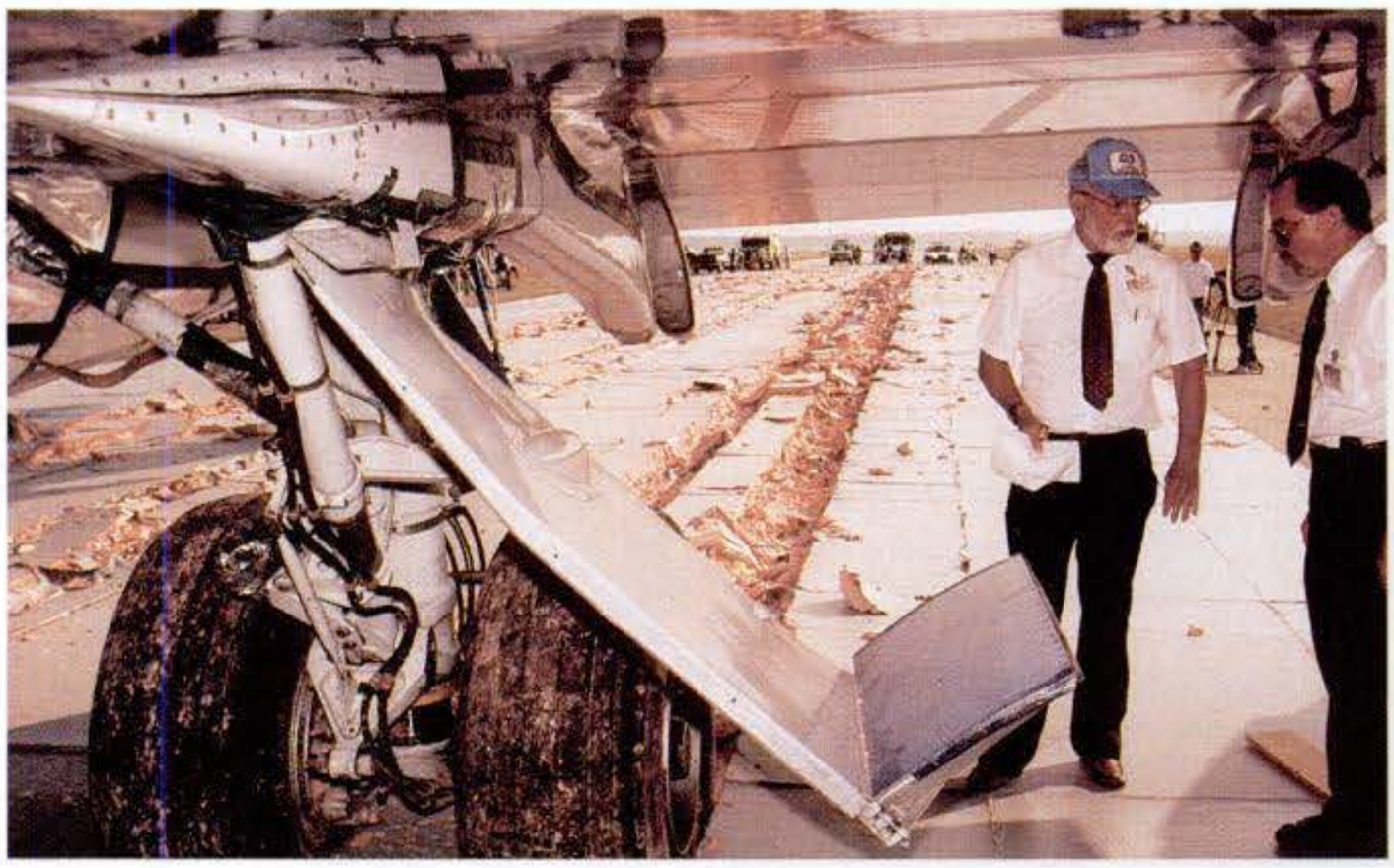
Stopping Planes in Their Tracks

THE FEDERAL Aviation Administration plans to construct barriers of collapsible concrete at the ends of aiport runways as an extra margin of safety. The first installation will be at New York's Kennedy Airport next year.

When a plane plows into the Soft Ground Arresting System, its tires crush the foot-thick layer of concrete down to just a couple of inches. That brings the plane to a halt without harming or trapping passengers, and the ruts left by the plane can later be filled with fresh concrete. In a field test at the FAA Technical Center in Atlantic City, New Jersey, the system stopped a Boeing 727 traveling at 55 mph, without brakes, within 400 feet.

The arresting system is made from cellular concrete, which is whipped to the consistency of shaving cream. The concrete must be strong enough to support fire trucks, yet weak enough to prevent damage to landing gear. According to FAA engineer Jim White, the key ingredient is an animal protein called an alkaloid polypeptide, the same substance that turns egg whites into a stiff meringue.

The concrete is currently poured and cured at the factory, then delivered in sheets, like foam insulation. But Engineered Systems of Aston, Pennsylvania, which helped the FAA develop the concrete, is searching for a compound that can be mixed and poured on site.—*Mark Gillespie*



Collapsible concrete barriers will soon prevent planes from overshooting airport runways.

SPACE

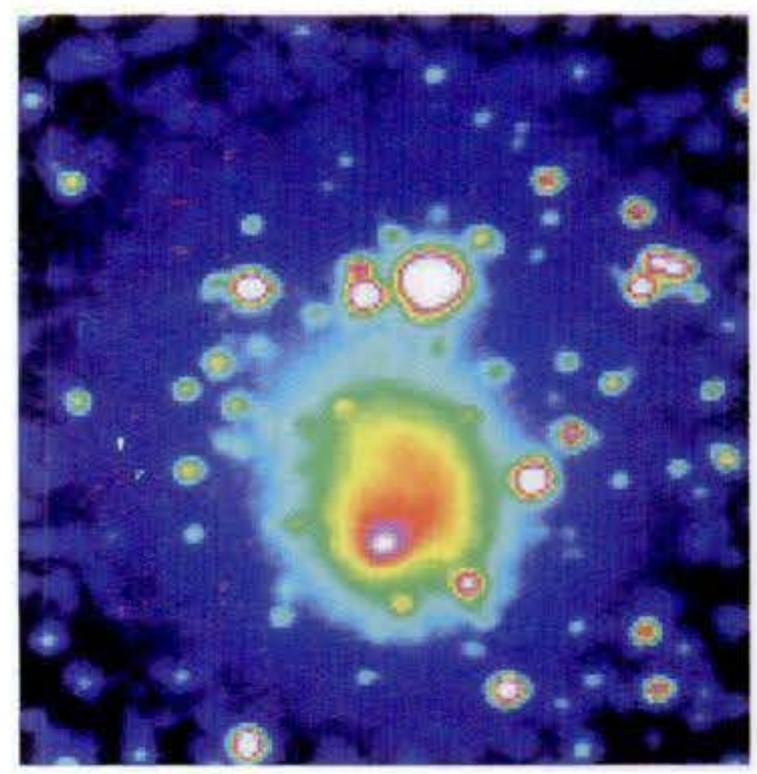
Tail Lights

A COMET discovered this summer is the brightest one ever seen at such a distance. Some 700 million miles from the sun when it was sighted in July, Comet Hale-Bopp could become as bright as Jupiter in the months before its closest approach to the sun on April 1, 1997, says astronomer Brian Marsden of the Harvard-Smithsonian Astrophysical Observatory in Cambridge, Massachusetts. When discovered, the comet was already almost as bright as Neptune, and by late February will be visible through a small telescope or large binocular.

Hale-Bopp, named after the amateur astronomers in New Mexico and Arizona who first reported seeing it, owes its brilliance to the light-reflecting dust that spews from its icy nucleus as it is warmed by the sun.

Astronomers are watching with trepidation because great expectations for comets have been dashed before. Comet Kohoutek was ballyhooed in 1973 for its early brightness, but it faded as it drew near the sun.

Hale-Bopp should fare better, says Marsden, whose calculations suggest that the comet has swung by the sun many times before, most recently some 4,600 years ago. That means Hale-Bopp is big enough to endure the repeated trips.—*David Graham*



Amateur astronomers spotted Comet Hale-Bopp.

GEOLOGY

Killer Volcanoes

A METEOR impact may have wiped out the dinosaurs 65 million years ago, but the mass extinctions that occurred 250 million years ago were probably caused by volcanic eruptions, according to a study by two California geologists. They report that radiocarbon dates for sediment layers from the time of the extinctions precisely match the dates for massive lava flows in Siberia.

Molten rock rising through the Earth's crust caused eruptions that belched sunlight-blocking clouds of sulfur for about a million years. "In extreme cases such as this one, volcanoes in and of themselves appear to be sufficient to wipe out life on the planet," says Paul Renne of the Berkeley Geochronology Center.—*D.S.*

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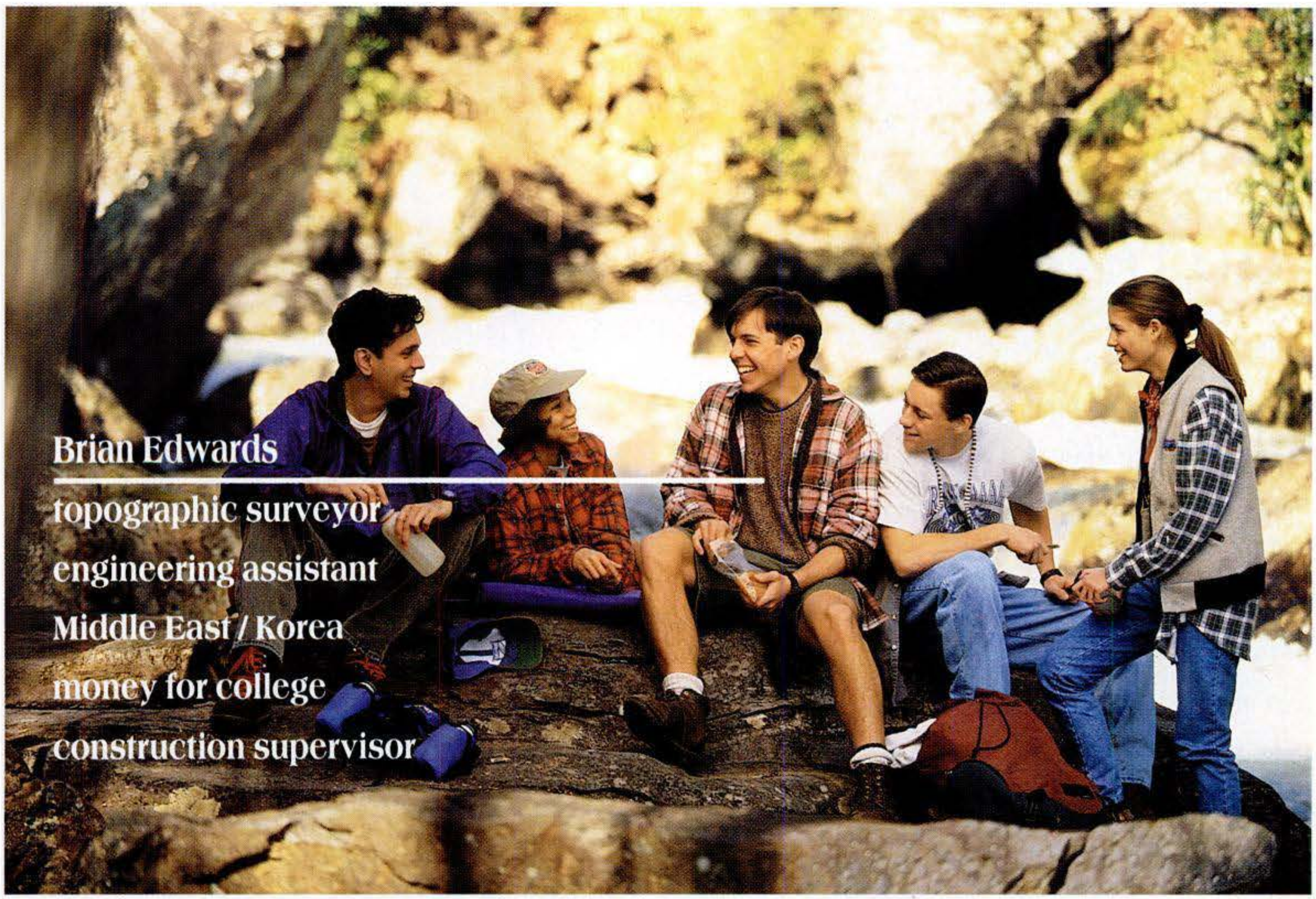
IN FOUR YEARS, YOU WON'T RECOGNIZE YOURSELF.



The right choices today can make a big difference tomorrow. This year, Brian Edwards and over 375,000 ambitious young men and women will find the opportunities, training, experience and encouragement they need in the U.S. Armed Forces.

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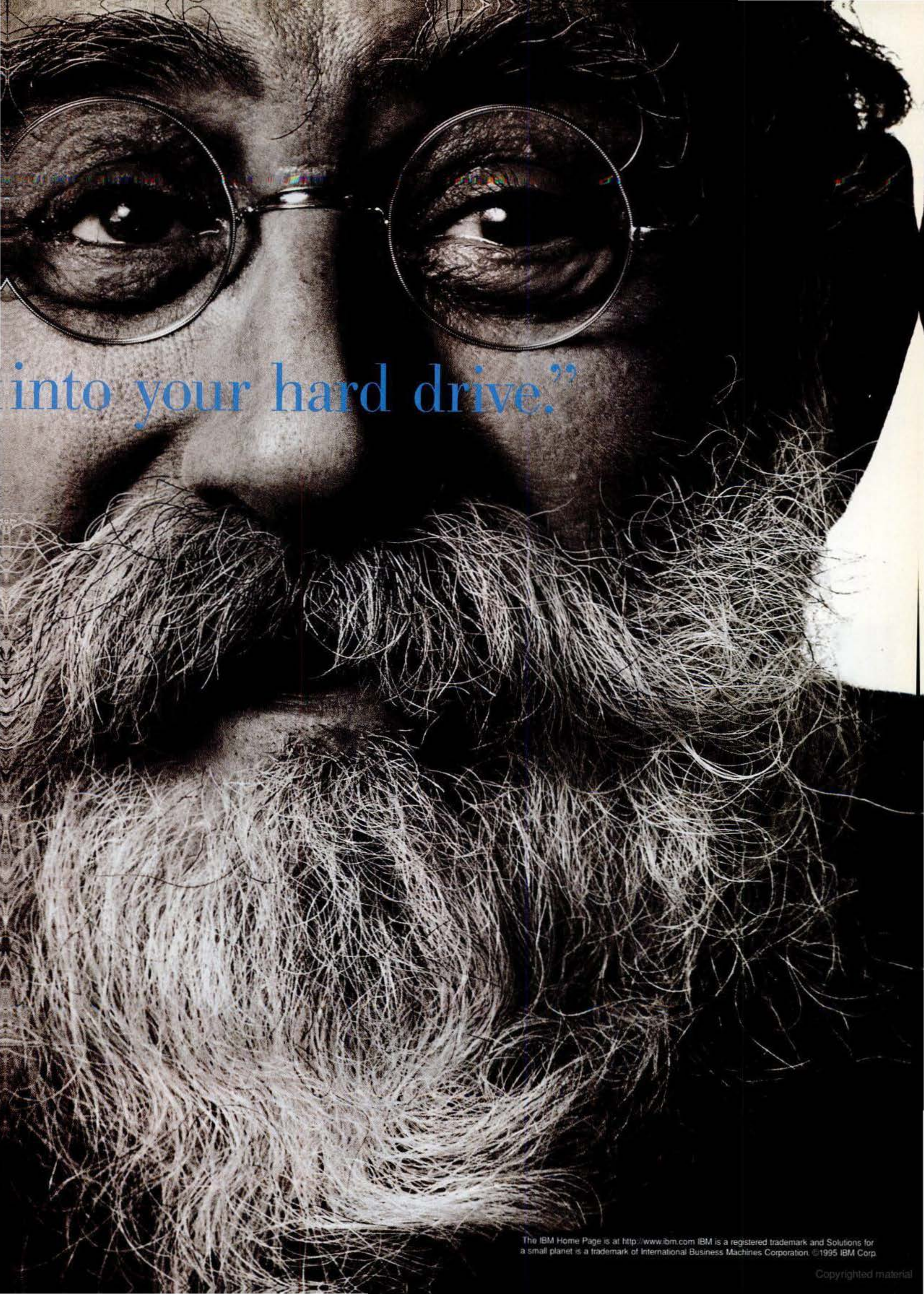

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ENVIRONMENT

Turning Sewage to Snow

GETTING RID of sewage can be as easy as freezing it, according to a Canadian company that has developed a wastewater treatment called Snowfluent [see "Best of What's New," this issue].

The essential ingredients of the new treatment are subfreezing temperatures and modified snow-making equipment. From nozzles mounted on a tower, wastewater is sprayed at extremely high pressure. Tiny droplets instantly crystallize in the cold air and fall to the ground as snow, forming piles up to 50 feet high.

The rapid crystallization ruptures the cell membranes of bacteria and other microorganisms, destroying them. Other contaminants, such as nitrogen and phosphorus, fall to the ground. When the snow melts in the spring, the nitrogen escapes into the atmosphere as ammonia gas. Phosphorus, which can cause unwanted algae blooms if discharged into waterways, instead could play a beneficial role as a fertilizer by slowly seeping into the soil.

"The environmental results are better than existing plants, and the technology is cheaper," claims Jeff White, president of Delta Engineering, an Ottawa company that designs snow-making equipment for ski resorts. Delta modified its equipment to create the Snowfluent process.

Snowfluent could save money by eliminating the need for large, costly sewage treatment lagoons. Last winter, Delta Engineering installed the first Snowfluent plant in Maine's Carrabassett Valley.—*Robert Burg*

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TRANSPORTATION

K. DANIEL CLARK

Wheels for Hire

CHICAGO'S Regional Transportation Authority is betting that Personal Rapid Transit, or PRT 2000, can help solve the growing problem of suburban traffic congestion.

A large, fully automated PRT system consists of small, electrically powered vehicles (seating up to four people) traveling at 30 mph (48 kph) on an elevated steel guideway laid out in a network of interconnected loops. The design is based on computer simulations perfected over two decades by Edward Anderson, a professor of mechanical engineering at Boston University.

Unlike most public transportation systems, PRT doesn't require riders to wait for vehicles. Instead, empty vehicles wait for riders in off-line stations. A passenger selects his destination from an automated ticketing machine that dispenses a magnetically encoded ticket. After purchasing his ticket, the passenger swipes it through a ticket reader that allows him to board a vehicle programmed for his destination.

To demonstrate the system, Massachusetts-based Raytheon is building a one-kilometer oval guideway and three prototype vehicles at its Marlborough facility. If they perform as expected, the Chicago-area RTA is planning to construct a five-kilometer, 45-vehicle system linking commuter rail and bus lines in Rosemont, Illinois, with hotels and a convention center by 1999. The system may later be extended to include O'Hare Airport.—*Neville Harriss*

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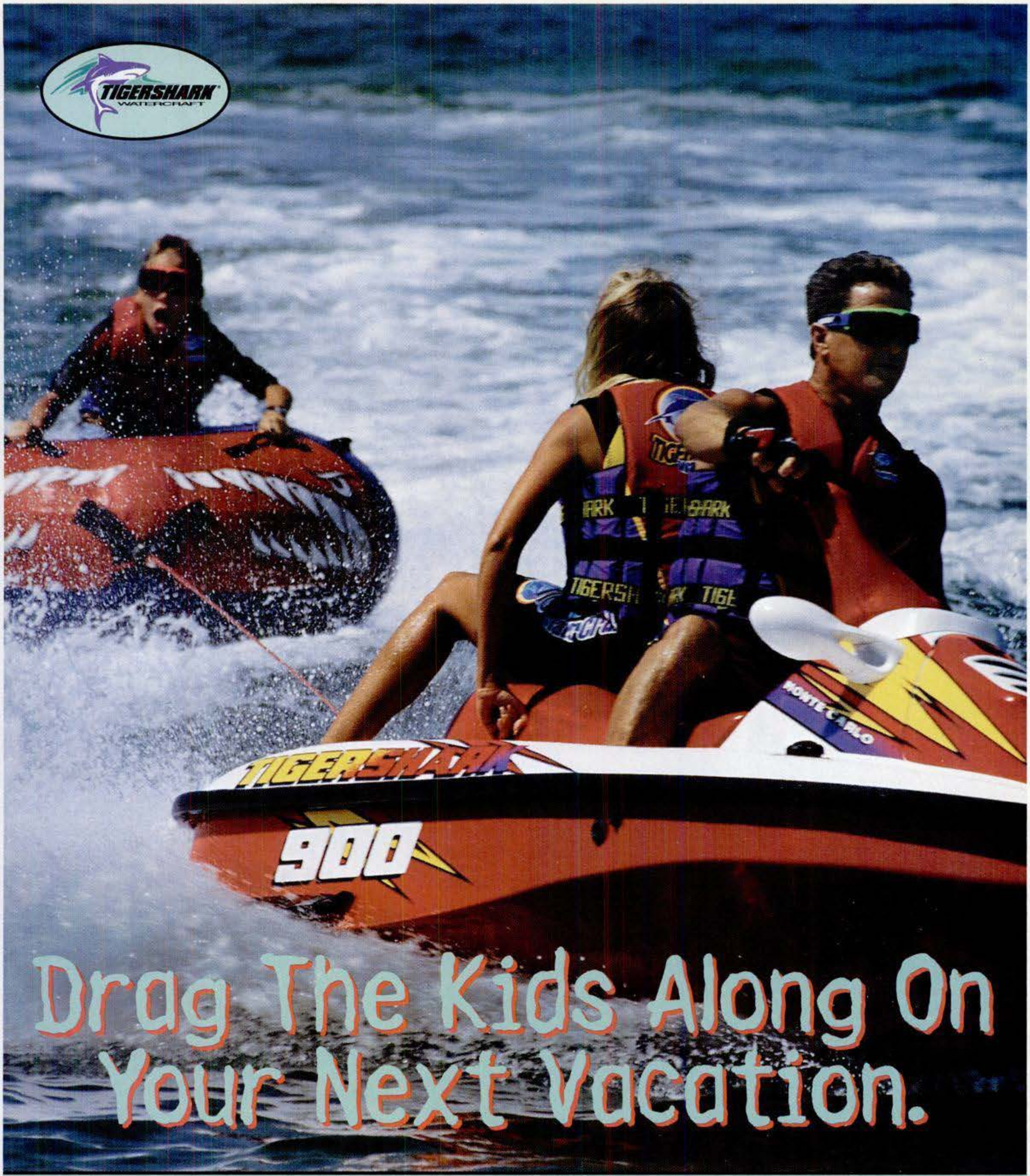

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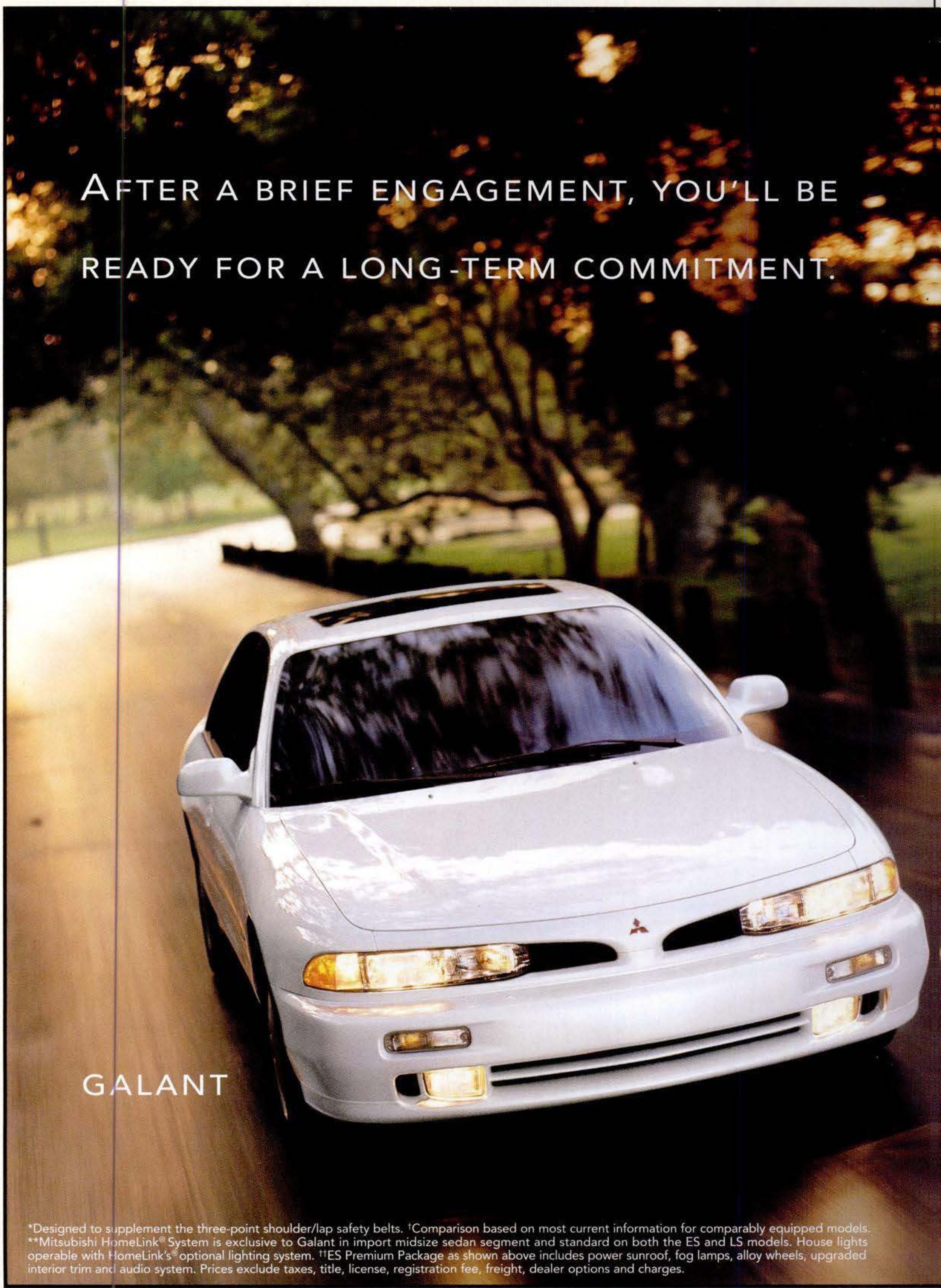

*Designed to supplement the three-point shoulder/lap safety belts. †Comparison based on most current information for comparably equipped models. **Mitsubishi HomeLink® System is exclusive to Galant in import midsize sedan segment and standard on both the ES and LS models. House lights operable with HomeLink's® optional lighting system. ††ES Premium Package as shown above includes power sunroof, fog lamps, alloy wheels, upgraded interior trim and audio system. Prices exclude taxes, title, license, registration fee, freight, dealer options and charges.

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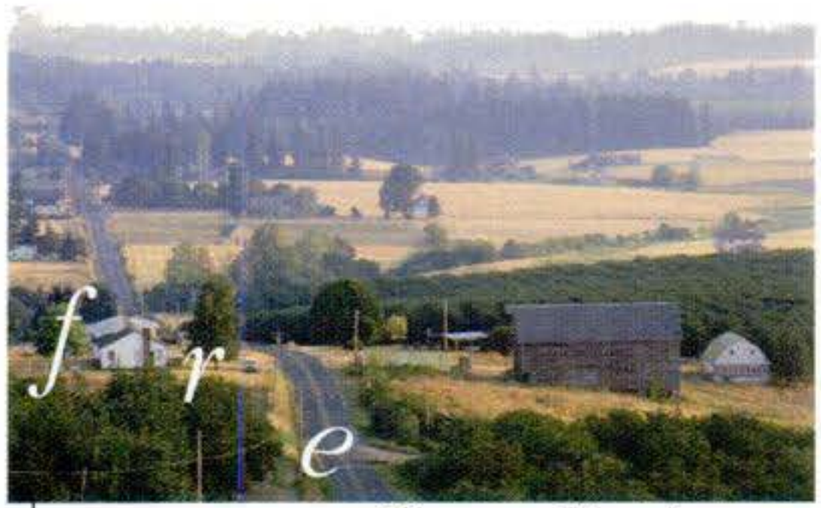
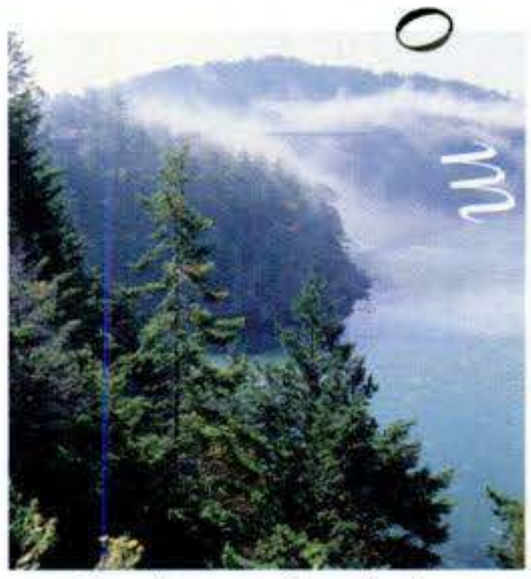
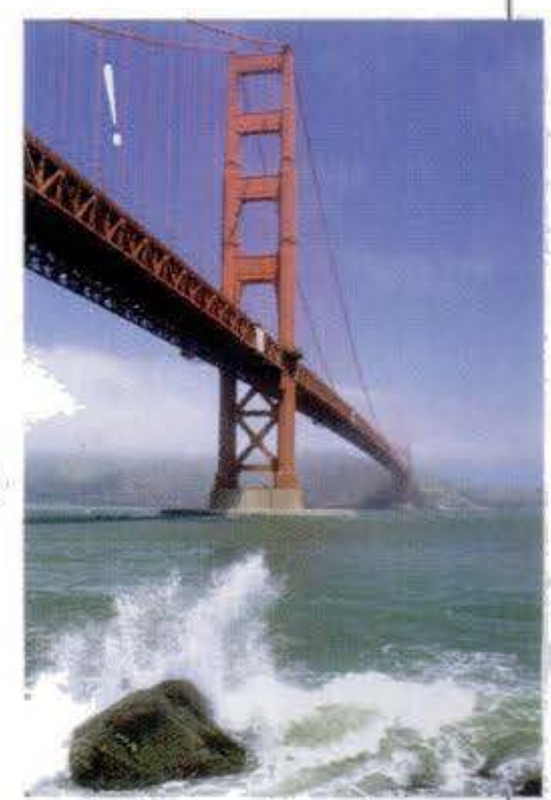


The road beckons...



...past scenic vistas...

...through rolling hills...



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COMPUTERS & SOFTWARE

EDITED BY CHRIS O'MALLEY

DIGITAL IMAGING

Wanted: Better Suspect Sketches

WITH THE DARK, scratchy quality of most police sketches, it's a wonder they help catch any suspects. How many more criminals might be nabbed with better renderings?

We may soon know the answer. A new program called C.R.I.M.E.S. (for Crime Reduction, Image Management and Enhancement System), developed by ImageWare Software of San Diego, is enabling police, witnesses, and victims to create photorealistic composites of suspects. Rather than rely on black-and-white foils, or facial overlays, the C.R.I.M.E.S. software uses a full-color database of skin tones, hair styles, noses, eyes, mouths, and even scars, among other features.

The resulting image looks more like a good, if slightly impressionistic, color photo than a hand-drawn charcoal sketch. (Suspect pictures are rarely drawn by hand anymore, but foils produce similarly sketchy results.) And the fact that it's a digitized image means it can be sent or faxed by modem to other law enforcement agencies. It also lets officers easily update composites and create variations on suspect appearances. The Windows software can even be run on a laptop to do composites at the crime scene.

Early adopters of the computerized approach include police departments in Boston, Los Angeles, and San Diego.—*C.O.*

To catch a thief (from left to right): a color photo, a police sketch, and a computerized image.

DISK STORAGE

Reviving the Floppy

WITH A MERE 1.44MB of storage space, the 3.5-inch floppy disk seems outdated in this age of CD-ROM and gigabyte hard drives. But that may soon change.

Compaq is working with 3M and Matsushita to perfect a new 3.5-inch floppy disk system that will hold up to 120MB, and read and write data five times as fast as current floppies. The new drive, expected to begin showing up in PCs this month, will also be able to read existing floppies.

This is not the first attempt at a high-capacity, easily portable disk. Iomega Corp.'s popular Zip drive holds 100MB, and its new Jaz drive will hold up to 1GB of data. But the new 100MB floppy disk will likely become standard equipment rather than an extra-cost option.—*C.O.*

TRIVIA

Windows 95 Mania

THE WORLD SEEMS to be crazy about Windows 95—maybe a little too crazy. Here's some of the more telling trivia:

- Copies of Windows 95 already shipped to stores: 50 million
- Windows users in the world today: 100 million
- Languages in which Windows 95 will be available: 30
- Number of floppy disks Windows 95 comes on: 13 (or one CD-ROM)
- Programs tested to work with Windows 95: 2,500-plus
- Characters allowed in a Windows 95 file name: up to 225
- Expected number of Windows 95 book titles: 450
- Person-years of development invested in Windows 95: 293
- Lines of computer code in the program: about 11 million
- Babies born to Microsoft team members during Windows 95 development: 63
- Pounds of popcorn consumed by Windows 95 team: 4,850
- People who tested early versions of the program: 50,000
- Cost of Windows 95 launch events: less than *Waterworld*
- Number of reporters at August 24 launch: 600
- Colors of Microsoft flag: red, green, blue, and yellow
- Colors of Empire State Building on August 24: red, green, blue, and yellow
- Best launch gag: In Poland, promoters rented a submarine to show reporters what the world is like without Windows.
- Estimated dollars that Microsoft and other companies will spend marketing Windows 95 products by the end of 1995: 1 billion
- Jay Leno's only complaint about Windows 95: "They haven't publicized it enough."—*Dawn Stover*

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BEYOND HERE

The Good Spies?

BY GINA SMITH

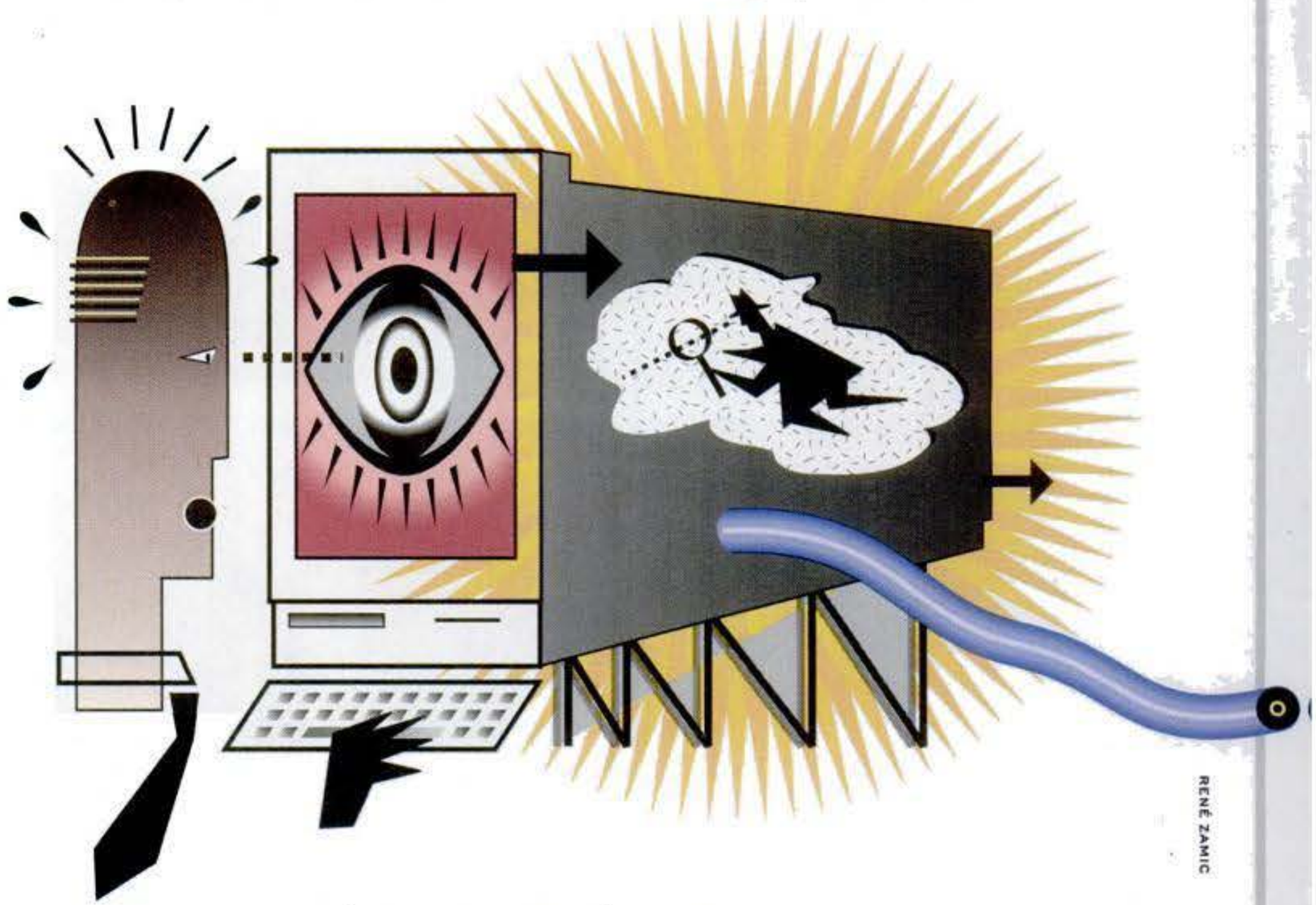
PICTURE THIS: You have a problem with your computer, and a technician comes to your house to fix it. You leave the room for a minute to let the dog out, and return to find the technician busily copying down the names and serial numbers of every piece of hardware and software you own, and the details on how you've got it all set up. When you ask him what he's doing, he says he needs all of this information for his files, and besides, it'll make your computer easier to fix the next time.

Thoughtful foresight, or unauthorized snooping? If you've used the new registration "wizard" in Windows 95, you may be asking yourself the same question. Sure, this automatic register-by-modem routine saves you the trouble of filling out a real registration card and licking a stamp, but it also scans your hard disk for software and hardware information and sends it all back to Microsoft headquarters.

Microsoft is not the first to do this, and it won't be the last. Many software publishers are coaxing you to register your ownership this way. And many hardware makers want to do the same to troubleshoot your PC via modem. That's making a lot of people nervous.

Why? Armed with such information, a company can track your buying habits, spy on the competition, send you all kinds of highly targeted junk mail, and even determine whether you have illegally copied software. At least, those are the things we *know* they can do.

Microsoft, in its defense, says it has no such intentions. The point of the wizard isn't to snoop, it's to help Microsoft keep you informed about product changes or upgrades, and to better serve you the next time you call for technical support. Plus, the wizard won't do anything unless you first approve its use, and it's only collecting "benign" data like system settings and such. (You can see exactly what the data is by viewing the REGINFO.TXT file on your computer.) Further, Microsoft says under no circumstances will it check serial numbers to see whether you've made illegal copies, nor will it badger you with junk mail.



RENÉ ZAMIC

And you can bet a lot of people will be watching to make sure Microsoft keeps these promises.

But even if a high-profile company like Microsoft can be trusted, it's not clear that everyone else can be. There are thousands of smaller players in the computer business who escape the public eye and have a lot less to lose. And here's where it gets really scary. It's already possible to do this sort of scanning without alerting the user, so it doesn't take much of a futurist to imagine the same sort of stealth technology being used on unknowing bulletin board and Internet users. In fact, I think a trend away from juvenile-prank computer viruses to information-seeking "spy" viruses isn't merely likely, it's inevitable.

Spying is even easier when there's alleged justification. Already, the copy-obsessed Software Publishers Association regularly barges into companies with search warrants and demands access to the hard disks of employees suspected of holding pirated software. How long do you think it will be before software publishers—armed with the "insider tips" that electronic spies provide—will start turning up in homes?

No doubt some software makers will see an opportunity to create a variation on today's virus detectors to hunt down spy viruses. (They get you coming and going, don't they?) But an even more insidious wave of spy viruses will surely emerge. All this spying *before* videoconferencing and interactive TV. And you thought Big Brother was nosy. Old Mr. Orwell must be spinning in his grave.

Gina Smith is a syndicated columnist and makes regular appearances on "Good Morning America." *You can send her e-mail at heyGina@aol.com.*

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http://www.crl.com/~lgenco/otr.html
The Shadow knows where to find sound clips from radio's yesteryears, and now you do, too.

Alcatraz
http://www.nps.gov/alcatraz/
No need to swim there. Alcatraz Island's colorful history is here in words and pictures.

French Lesson Home Page
http://teleglobe.ca/~leo/french.html
Oui! Brush up on basic French vocabulary and grammar online.

First Church of Cyberspace
http://www.execpc.com/~chender/
A very modern mix of music, pictures, animation and more offered by the Central Presbyterian Church of Montclair, New Jersey.

WWW Viewer Test Page
http://www-dsed.llnl.gov/documents/WWWtest.html
This is only a test. A quick check to see if you have the software to play audio and video clips.

Burn: Cycle
http://www.burncycle.com/
An online teaser for a CD-ROM game with the same name. (Requires Netscape Navigator)

Safari Touch Tank
http://oberon.educ.sfu.ca/splash/tank.htm
A virtual petting zoo for some undersea creatures.

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Everything you ever wanted to know (and wish you didn't) about the European Union.

—compiled by Suzanne Kantra Kirschner (kantra@aol.com)

SYSTEMS

Pentium Goes Pro

INTEL'S NEW Pentium Pro microprocessor (dubbed P6 during its development) finally has a name, and soon it'll find a home. Compaq, IBM, Gateway, and Midwest Micro are among the PC makers who plan to sell these systems before the end of this year.

As with the introduction of the original Pentium chip, some of the early Pentium Pro machines will be designed as powerful "servers" to run networks. The Pentium Pro chip is ideally suited for such duties, partly because it can be linked easily with other Pro chips to form very fast multiprocessor systems.

But, like Pentium, the Pro chip is expected to find its way into consumer PCs fairly quickly. Gateway, for one, says it intends to sell Pentium Pro systems at "consumer prices" almost immediately. In the first Pentium's case, the early debut of systems under $3,000 quickly led to an avalanche of affordably priced models.

The Pentium Pro is optimized to run 32-bit applications, so it's well-suited to Windows 95 systems and applications written for it. You'll see little or no improvement with older 16-bit applications, however, and Pro systems may even be slower than original Pentium systems running Windows 3.1.

The first Pro chips will run at speeds of 150MHz and 166MHz. New Pentium chips also running at 150MHz and 166MHz (though still not as fast as Pentium Pro chips) are also expected to begin showing up in PCs soon.—C.O.

Ben Franklin wanted to make it the national bird.

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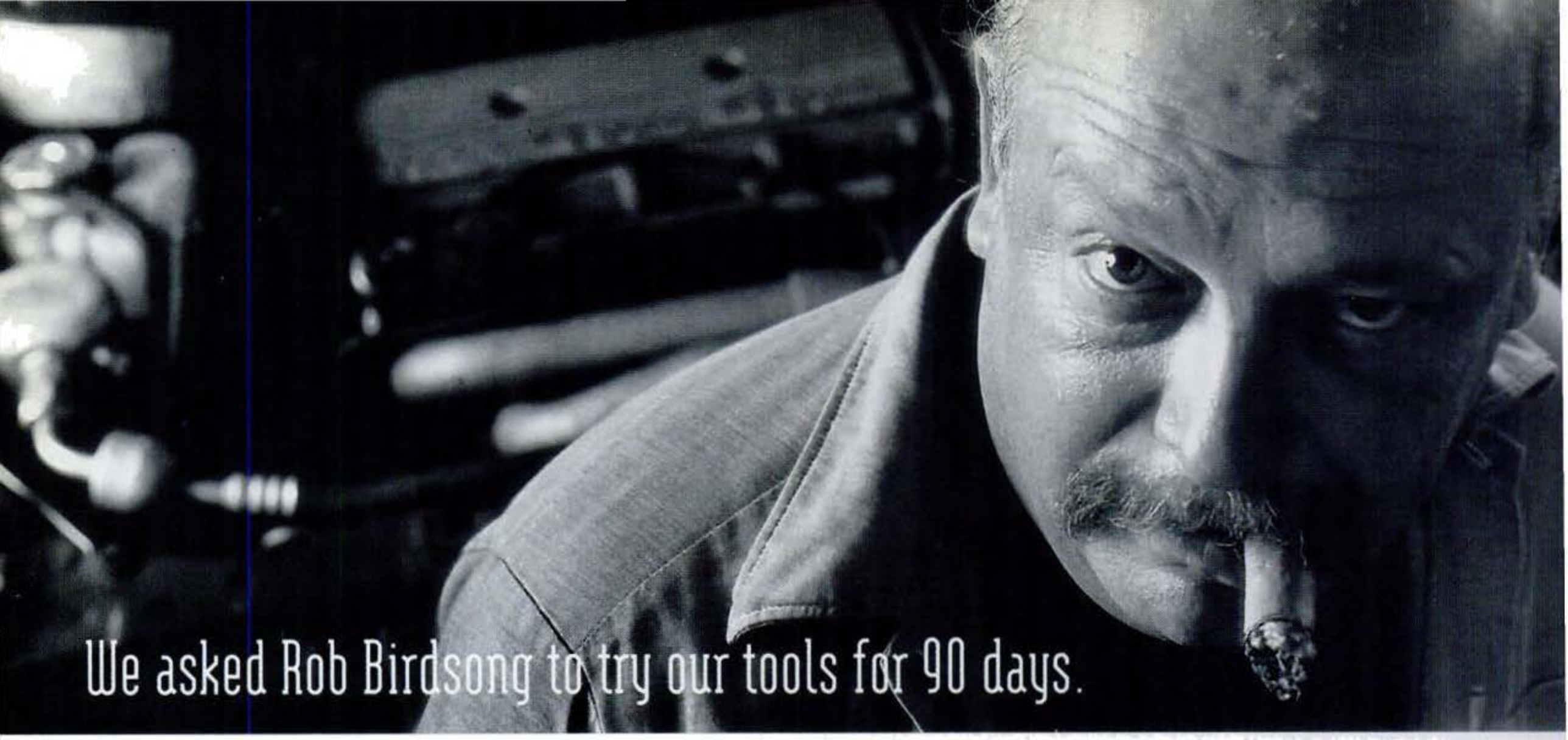
101 proof, real Kentucky.

Wild Turkey® Kentucky Straight Bourbon Whiskey, 50.5% Alc./Vol. (101°), Austin, Nichols Distilling Co., Lawrenceburg, KY. © 1994 Austin, Nichols & Co., Inc.



He said he only used tools he trusted.

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He said, "Okay, you got 90 days."

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HOME TECHNOLOGY

EDITED BY JUDITH ANNE GUNTHER

BUILDING TECHNOLOGY

Operation Foundation

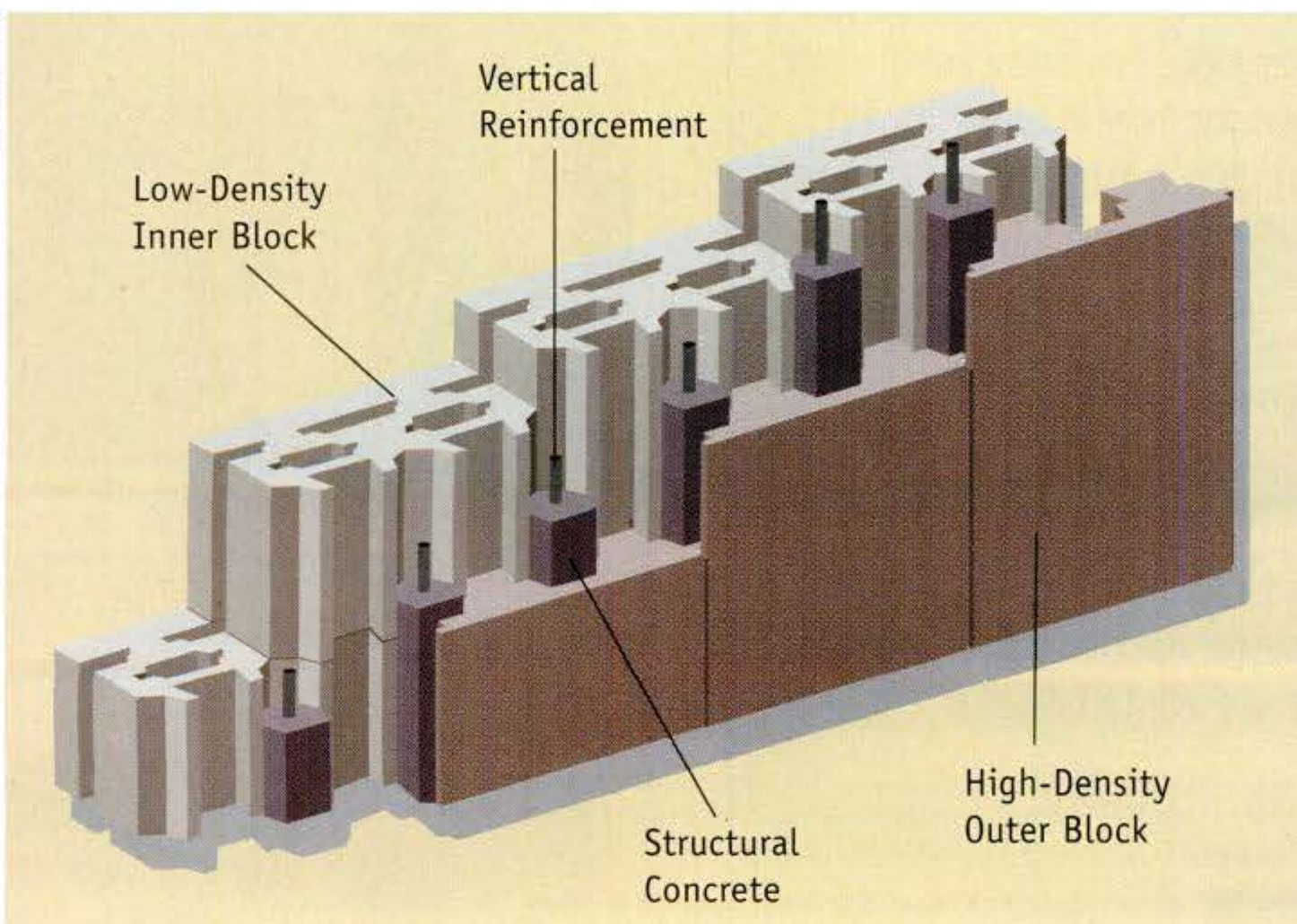
MANY BUILDERS have a hard time deciding the best way to insulate basements. Putting up interior stud walls filled with fiberglass batts is time-consuming. Exterior foam insulation invites termites to tunnel into the house and can fall victim to the ravages of ultraviolet light—or the neighborhood dog's teeth. Lightweight insulating blocks, which use air, fly ash, or polystyrene beads to boost their R-values, lack the strength and water-resistance of standard concrete.

Faced with the drawbacks of each of these methods, researchers at Oak Ridge National Laboratory recently set the unlikely goal of designing an affordable foundation system that provides the strength of traditional concrete but insulates with as much as 50 percent fly ash or other low-density additive. By all accounts, they've succeeded.

The patented system (which will be licensed to manufacturers) uses structural outer blocks of high-density concrete that are interlocked with lightweight, insulating inner concrete blocks. Vertical and horizontal steel reinforcing rods help stiffen the wall while pinning it to preformed footer blocks. According to Jeff Christian, the researcher who headed the project, the system's insulating values of R-6 to R-8 should satisfy most energy codes in the middle and southern United States; polystyrene inserts can raise the insulating value to R-15.

Christian expects costs to be competitive with a standard masonry wall with interior insulation. One advantage is the system's ease of use. Skilled masons are needed to lay the footers, but the wall blocks can be slipped together by anyone. In fact, Christian has fielded inquiries from Habitat for Humanity and other groups that build low-income homes with unskilled labor. —*Charles Wardell*

ANDY CHRISTIE



Dynamic duo: A foundation system combines strong concrete blocks with blocks that insulate.

INDOOR AIR QUALITY

Inert is Not the Same as Harmless

WORRIED ABOUT using indoor insecticides? You may be surprised to learn that the inert ingredients listed on the package may be more likely to make you sick than the active pesticides.

"The word 'inert' on a can of roach spray doesn't mean those compounds are inactive and unreactive. It just means they don't kill roaches," says pesticide specialist John Bukowski of the New Jersey Department of Environmental Protection. These ingredients are often volatile organic compounds (VOCs) like xylene, methyl ethyl benzene, or kerosene; many of these compounds are known to cause headaches, drowsiness, and nausea, as well as to irritate the eyes, nose, and mouth.

Bukowski and an associate, Leroy Meyer, used a sophisticated computer model to simulate airborne VOC levels following the application of different indoor insecticides. When used in aerosol sprays and foggers, VOCs can remain in the potentially irritating range for up to 24 hours, they found. Pesticide concentrates that are diluted in water and then applied directly to corners or cracks, by comparison, release few VOCs. The model also revealed that ample, timely ventilation rapidly reduces levels of the irritating compounds.

In addition, the researchers examined the labels on 126 insecticides registered for indoor use in New Jersey. They found only 10 percent of the labels had references to ventilation.

For more information about pesticides, consumers can contact the National Pesticide Telecommunications Network at 800-858-7378.—*P. J. Skerrett*

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It may be small. But the Bose® Acoustic Wave® music system is definitely an overachiever. The unit holds a compact disc player (or cassette), AM/FM radio, and Bose's patented acoustic waveguide speaker technology. And produces a rich, natural sound quality comparable to audio systems costing thousands of dollars. We know, that's hard to believe. So we're ready to prove it. Call or write now for our complimentary guide to this award-winning system. Because, like the system itself, it is only available direct from Bose.

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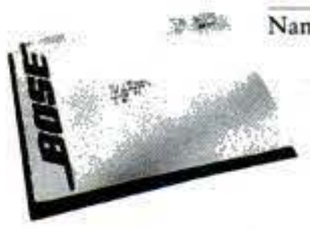

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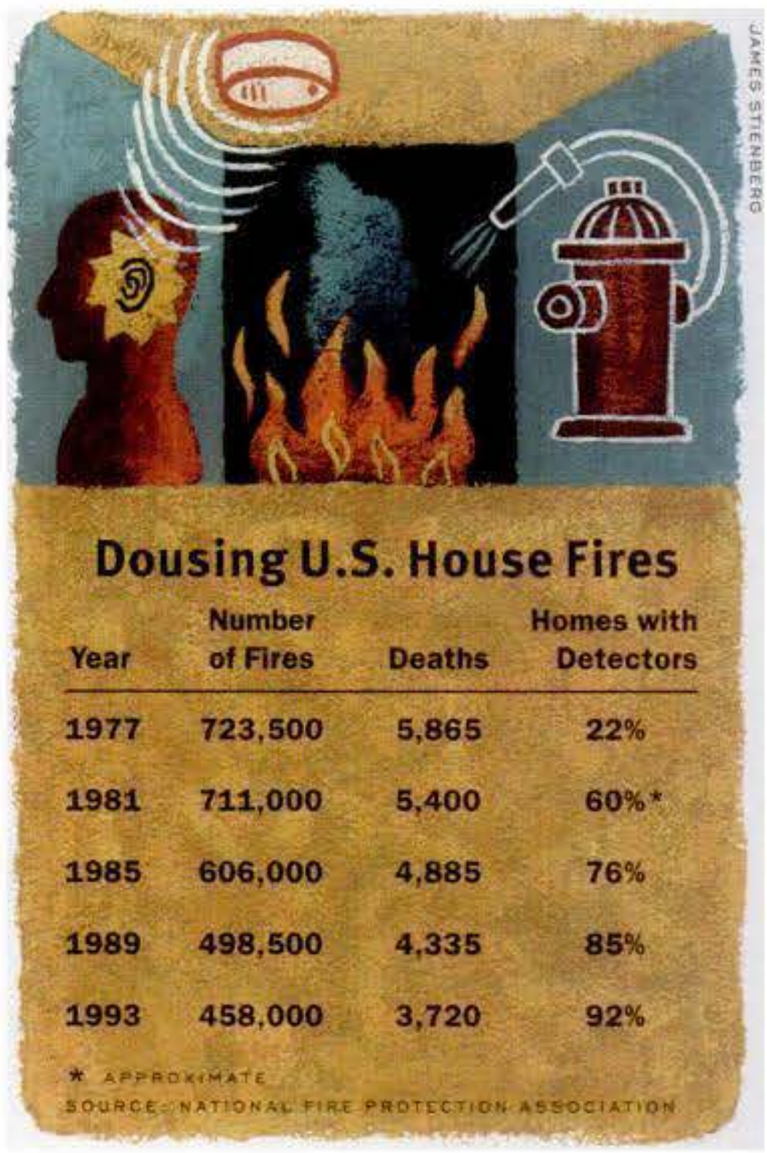
SAFETY

Where There's Smoke...

DECEMBER MAY be a month for holiday celebrations, but traditionally it's also the month with the most house fires. From 1988 to 1992, 11 percent of all residential fires occurred in the last month of the year; January has the second-highest rate, with 10.8 percent of all house fires.

Experts at the National Fire Protection Association in Quincy, Massachusetts, cite portable heaters and other heating equipment as the culprits for the rise in house fires during these two cold months. From December through February, for example, one-third of these fires were caused by heating equipment.

The good news is that over the past 16 years the total number of residential fires has decreased dramatically—and so has the number of deaths due to these types of fires. Not coincidentally, the percentage of homes equipped with smoke detectors simultaneously has steadily increased. As one NFPA expert puts it, "Smoke detectors are obviously making a difference."—*J.A.G.*



JAMES STEINBERG

Dousing U.S. House Fires

Year	Number of Fires	Deaths	Homes with Detectors
1977	723,500	5,865	22%
1981	711,000	5,400	60%*
1985	606,000	4,885	76%
1989	498,500	4,335	85%
1993	458,000	3,720	92%

* APPROXIMATE

SOURCE: NATIONAL FIRE PROTECTION ASSOCIATION

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INDOOR POLLUTION

Technology Defuses a Deadly Gas

ACCORDING TO the National Center for Health Statistics, unintentional carbon-monoxide poisoning kills nearly 600 people annually. The odorless gas is produced by the incomplete combustion of gasoline, propane, or other fuels. Detection systems can help warn homeowners when carbon monoxide levels become significant. But now another technology, developed at NASA's Langley Research Center, can turn the deadly gas into a harmless one.

Langley scientists, led by Billy Upchurch, created a catalytic device using a ceramic honeycomb covered with tin oxide and platinum. When carbon monoxide passes through this honeycomb, it reacts chemically with the metals and converts to harmless carbon dioxide [see "Best of What's New," this issue].

In collaboration with Rochester Gas & Electric in upstate New York, NASA is developing the catalyst for home use. Yvonne Selbig, an environmental analyst at the utility, says that "in the long term, we envision a catalyst-filter combination that would go into an existing heating-and-cooling system, without any modifications." In upcoming field experiments, prototype catalysts will be placed in a Rochester Gas & Electric truck bay, the pathology laboratory at Rochester General Hospital, and, eventually, a customer's house. Those tests should reveal any difficulties in using the catalyst outside the lab, but NASA's Upchurch says he does not "anticipate any problems in making the conversion from the laboratory tests to home tests."

Although the catalyst's availability and pricing remain uncertain, Upchurch believes it might be marketed in a year.—*Mike May*

The Dremel MultiPro.

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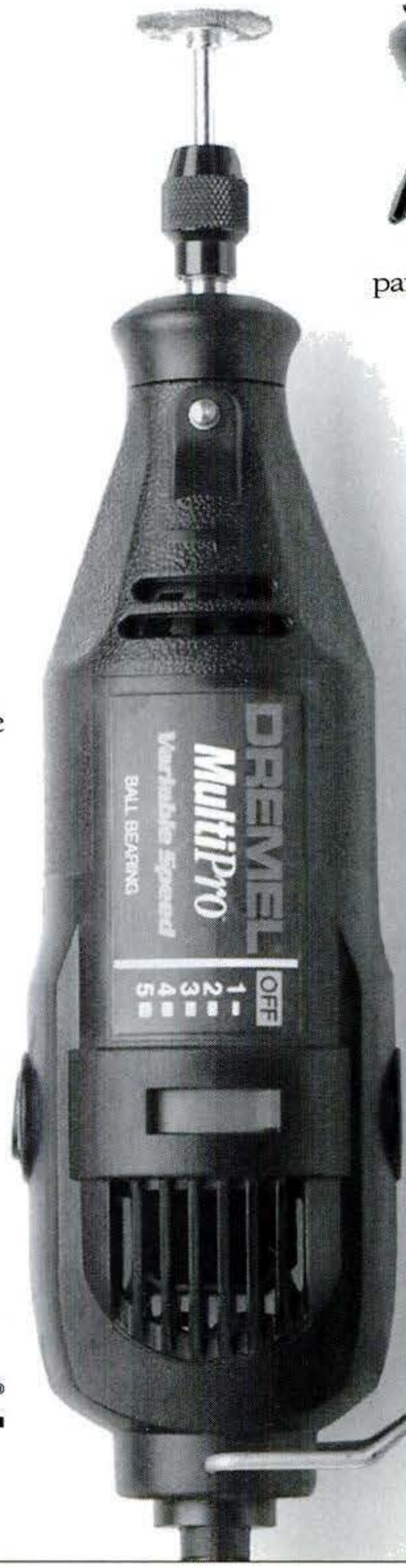

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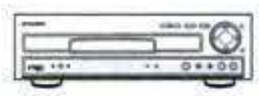

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ADVANCED HOME THEATER

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ELECTRONICS

EDITED BY MICHAEL ANTONOFF

Holographic photos and decorative stereograms can now be printed on a disc.

COMPACT DISCS

You're Not Hallucinating

THE EMBEDDED images on the compact disc are uncanny. As I swivel the disc in my hands, the woman pictured in the holographic photo flashes a smile. Marquee-like arrays and hypnotic eyeballs pulsate. Combined with the rainbow reflection that's found on any shiny CD, the holographic disc provides a great opening act for the music itself.

Holographic CDs are a novel way for a rock group, for example, to put its personality—be it a neon logo or a smirk from the lead singer—onto a disc. The discs also thwart piracy, since trying to duplicate the hologram destroys the image, according to John Town, corporate director of Research and Development for Nimbus CD International. The Charlottesville, Virginia, company expects either to manufacture the discs or license its own hologram-embossing process soon.

The holograms could be used to decorate CD-ROMs and video CDs. Embossing a Photo CD with one or more of an amateur photographer's snapshots isn't likely, however. Town says the process is too expensive to be used for limited quantities; the price drops when the CDs are mass produced. So when the technique is used by a music label, the cost won't be much more than that of a regular disc.—*M.A.*

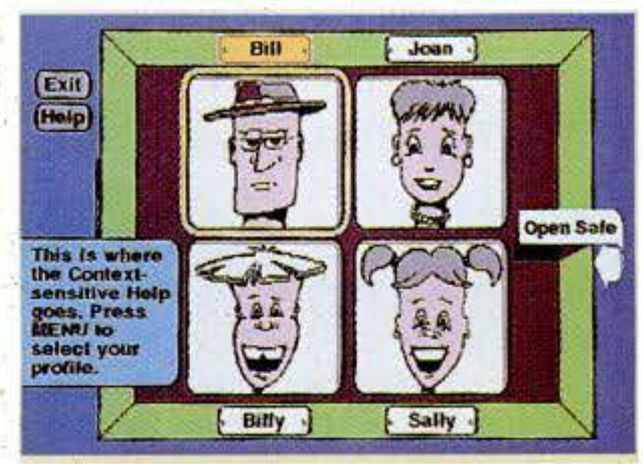
SATELLITE TV

Family Icons Narrow Viewing Choices

TURN ON A TV connected to new models of the RCA Digital Satellite System, and you may be greeted by user-decorated cartoon faces—up to four of them—meant to represent family members. Choosing one results in a personalized menu with access to as few as five channels.

Because DSS households can subscribe to 175 channels, a favorite-channel menu could be a good thing. But the mug shots are really meant for parents who want to use the interface to restrict their children's program access. The system also enables parents to include ratings limits for programs on, say, HBO. (The movie ratings code is already in the digital stream, years ahead of whatever form a federally mandated "V-chip" takes.) Pay-per-view can be controlled by specific spending limits, too. A master four-digit personal identification number must be input to change restrictions.

So when a child selects a personalized icon, he or she might find a so-called "favorite channel list" that's been reduced to Nickeledeon, the Cartoon Network, the Learning Channel, the Discovery Channel, and multichannel HBO (as long as what's being broadcast is G-rated). We wonder, though, how many hours it will take an electronics-literate child to break the code and lock out his parents from all fare except The Weather Channel and C-Span.—*M.A.*



Icons help you access favorite channels.

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VCRS

Onscreen Guide Debuts

INTRIGUED BY electronic onscreen program guides such as StarSight, but don't want to pay a monthly fee? Gemstar Development, maker of VCR Plus +, which lets you program your VCR using the number in a newspaper's TV listings, is collaborating with the ABC television network for this fall's launch of Index Plus +, a tape-indexing system with an onscreen guide that requires no monthly fee.

Index Plus + displays a directory of shows recorded on a videocassette and automatically fast forwards or rewinds to selected programs. The system creates a library of all the shows recorded on that VCR so a viewer can be directed to the exact spot on a specific tape in a collection. VCRs with Index Plus + can also access the program name and channel number during live viewing and can display a list of the rest of the day's programming by channel.

ABC is transmitting information about all broadcast and cable channels on a line in its vertical blanking interval (VBI). StarSight uses a different VBI line leased from PBS. The first VCR incorporating Index Plus+ will be available soon, when JVC debuts the HR-IP820U ($600). RCA, Magnavox, Sharp, Panasonic, Hitachi, and Mitsubishi, among others, have licensed the technology.

Starting in early 1996, Gemstar will also tap ABC-transmitted VBI information to debut Guide Plus+, a free interactive onscreen guide. Guide Plus+, which will be incorporated into TVs and VCRs, will provide TV program listings and show summaries about current and future programs. The system, like Index Plus+, allows for real-time updates of listings by participating broadcasters, which are being courted by Gemstar. Both systems offer a point-and-record capability.

Unlike StarSight's week-long listing, most Guide Plus+ information is restricted to the next two days; but viewers can locate programming for the next seven days by categories, such as "Sports" and "Movies."

Models are soon expected from several companies.—*Marjorie Costel*

Guide Plus+ lists the show you've just selected.

HANDS ON

JOHN B. CARNETT

RCA's hi-fi VR678HF VCR is so smart it skips over commercials on playback.

Bypassing Commercials with a Clever VCR

SUPPOSE a VCR maker's 30-second spot could honestly proclaim: "Buy our deck and you'll never have to watch this commercial again." Would the world buy in?

RCA is about to find out. The company has introduced a pair of VCRs, the hi-fi VR678HF ($499) [see "Best of What's New," this issue] and the VR542 ($399), boasting a technology called Commercial Advance that automatically blanks commercials on playback.

The VCR system works by detecting the brief, silent black fades that are broadcast before and after commercial breaks. After a recording session, RCA's VCRs spend a few minutes analyzing the tape and inserting control codes. When you play the tape and reach a commercial break, the VCR mutes the audio, shifts into fast-scan, and resumes normal speed the moment the ads end. Viewers can either mask the picture with a blue screen or glimpse the speeded-up commercials.

We put the VR678HF through its paces and are happy to report that it delivers. The blue screen, which lasts about 20 seconds for what normally would be a 2.5-minute program interruption, is a calming alternative. We tried the VCR on drama ("ER" and "The X-Files"), an evening of PBS, sitcoms, and cartoons. It performed excellently overall, missing only PBS fund-raising appeals and a few brief, between-show program announcements that were not separated by conventional ad breaks. It also inadvertently deleted an occasional snippet of program credits.

Commercial Advance is easy to use and creates no difficulties in operating the VCR.—*Stan Pinkwas*

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The 3D Difference

THE 2D WORLD of 16-bit Nintendo and Sega Genesis systems is viewed from the front. The figures or background scrolls from left to right and shading is added to give the illusion of depth, but the characters are merely flat groups of pixels mired in a fixed-camera perspective.

The most visible distinction of the 32-bit Sony PlayStation and Sega Saturn platforms is the leap to wrap-around perspectives. These platforms move the action seamlessly between foreground and background while the viewpoint pans, zooms, and circles 360 degrees, as well as from above and below the faces of the characters. In some games, an instant replay feature shows a fight or car race from a completely different viewpoint.

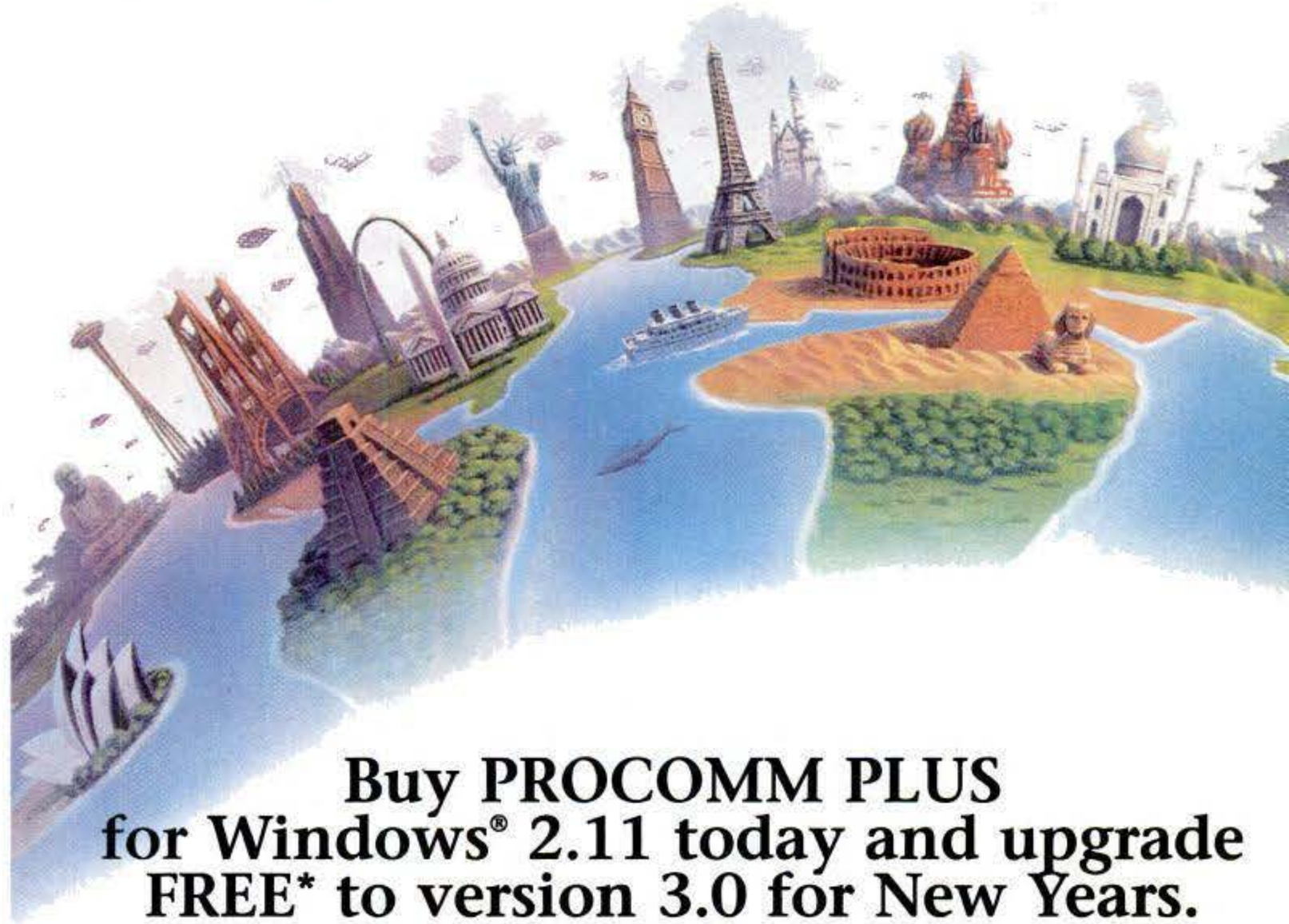
John Stanish, an analyst at Dakin Securities, an investment research firm in San Francisco, says these video game platforms "mark the beginning of a new technology cycle that brings real-time 3D graphics to the mass market."

Three-dimensional objects, are comprised of polygons and are visu-

The perspective is dynamic in Toh Shin Den.

ally represented by wire-frame diagrams. Detail is added to the wire frame by filling the polygons with textures and applying shading. As the position of the object with respect to the viewer changes, the vertices of each polygon are recomputed, the object redrawn, and textures and shading reapplied. Figures rotate freely and are rendered on the fly.—*M.A.*

One World. One Communications Software One Out-Of-This-World Offer!



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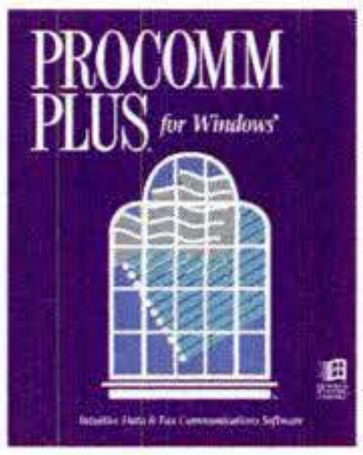

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With Dakota, you get the safety of a standard driver's airbag and standard rear-wheel anti-lock brakes.

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THE 8TH ANNUAL

BEST OF WHAT'S NEW 1995 AWARDS

The Year's 100 Greatest Achievements In Science And Technology

WELCOME TO a POPULAR SCIENCE tradition: The Best of What's New, a celebration of the year's 100 top products, technologies, and breakthroughs as selected by the editors. This year, science reaches back to human beginnings, discovering fossils of our earliest upright ancestor, ancient cave paintings, and a tomb built by a great pharaoh. And technology propels us into the future, with a camcorder that obeys our eyes, a car that won't skid, and software that will transform our interactions with computers. On the following pages, you'll find a Grand Winner in each of 10 categories. We also invite you to visit our Best of What's New World Wide Web site, http://bwn.popsci.com—*The Editors*

Edited by Mariette DiChristina

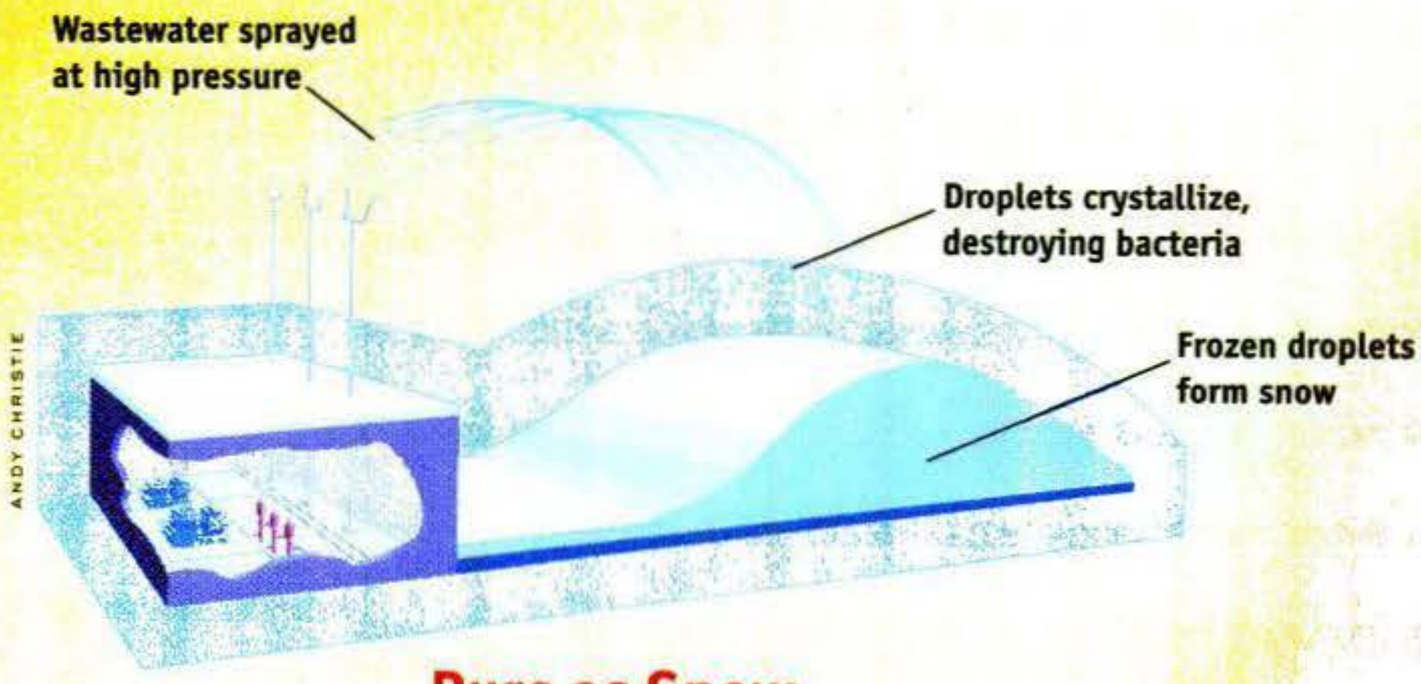
Rough but Civil

SUBARU HIT on a great idea: Build a rough-country vehicle that doesn't look and behave like a box on wheels [see Automotive Newsfront, this issue]. The Legacy Outback station wagon has the ground clearance and all-wheel drive needed to negotiate snow and unpaved terrain. Ample space for cargo and a tough suspension make the Outback a sensible alternative to fuel-gulping sport-utility vehicles. Prices start at $22,000; the automatic, which has a new, more powerful 2.5-liter engine, costs $23,000.

Saturn's "New" Moons

THEY'VE BEEN THERE for a long time, but we just found out. Astronomers using the Hubble Space Telescope discovered as many as four previously unobserved moons—the largest just 45 miles in diameter—orbiting the planet Saturn. Researchers at Lowell Observatory and the University of Arizona's Lunar and Planetary Laboratory spotted the moons in images taken late last summer, when Earth made its once-every-15-years crossing of Saturn's ring plane. The moons bring Saturn's total to at least 20 natural satellites.

K. DANIEL CLARK



ANDY CHRISTIE

Pure as Snow

LAST FEBRUARY, some snow-making equipment in Carrabassett, Maine, wasn't putting the usual white stuff on the slopes. Instead, it was purifying wastewater. Snowfluent, a clever system developed by Delta Engineering of Ottawa, Ont., *freezes* impurities out of effluent, eliminating costlier chemical treatments [see Science and Technology Newsfront, this issue]. Pressurized wastewater sprayed into cold air crystallizes—killing bacteria and separating out contaminants like nitrogen and phosphorous; these elements become fertilizer when the snowpack melts. Versions of the system are also being tested in Canada and a community near the Arctic Circle.

Making Quality Video

SONY'S DCR-VX1000 digital video camera delivers the highest quality consumer video. Its three 410,000-pixel CCDs (charge-coupled devices) produce a picture with about 500 lines of horizontal resolution—sharper than broadcast TV. The four tracks of 12-bit audio mean you can record and dub over in stereo. The $4,199 camcorder takes a 30- and 60-minute mini-cassette and records for one hour with its rechargeable lithium-ion battery.

ICON ILLUSTRATION BY JOHN HERSEY

For more information see RESOURCES on page 113.

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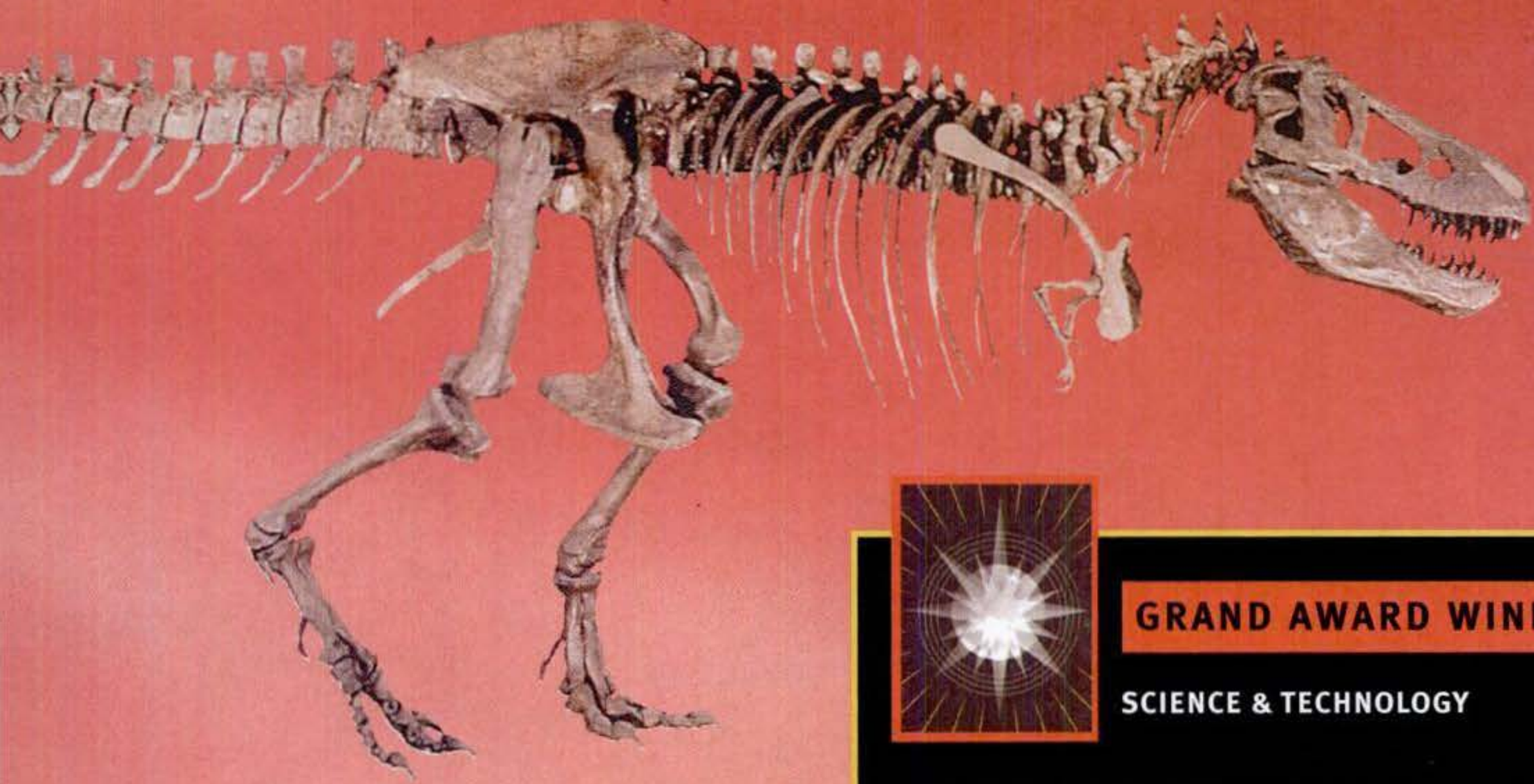


Return of the Dinosaurs

AFTER BEING CLOSED for three years for a complete redesign, the famed dinosaur halls of New York's American Museum of Natural History reopened with a bang in June. Of the hundred or so specimens on display, ranging from a dinosaur embryo to 8½-ton adults, 85 percent are now genuine fossils, not reproductions. New research has resulted in startling changes: For instance, the formidable meat-eating *Tyrannosaurus rex* no longer looms upright, but instead stalks low to the ground.

GRAND AWARD WINNER

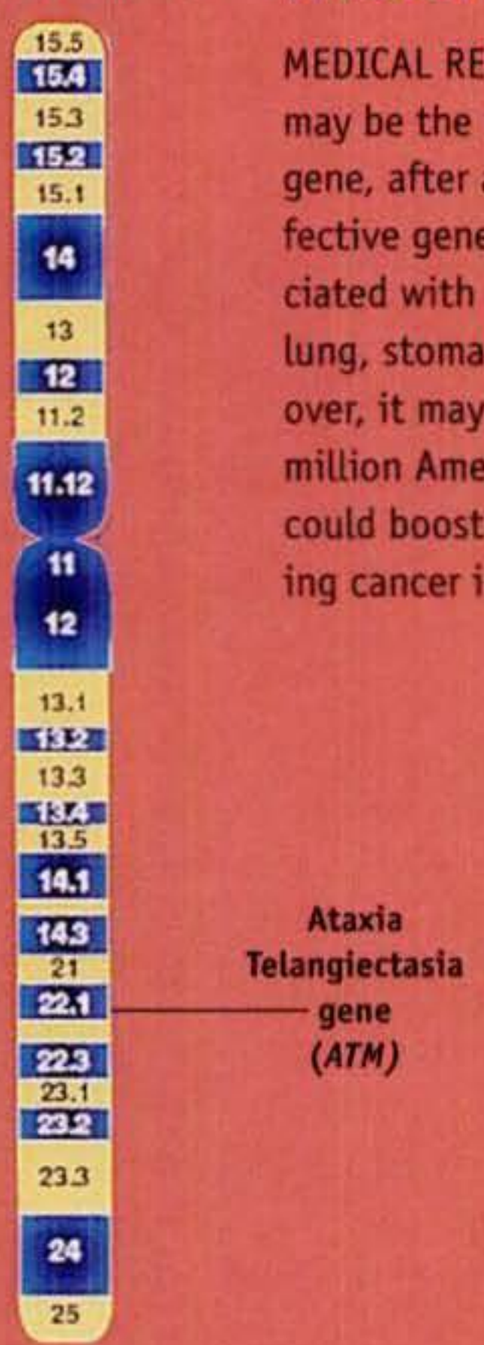
SCIENCE & TECHNOLOGY

JOHN SHOLTIS, ROCKEFELLER UNIVERSITY

The Fat and the Thin of It

A MILESTONE in the fight against obesity, the most prevalent disease among Americans, has been reached in experiments by Dr. Jeffrey Friedman and colleagues at Rockefeller University and the Howard Hughes Medical Institute. Obese mice, which have a mutated *ob* gene, were injected with the hormone leptin, which the normal gene produces in both mice and men. Result: The hefty mice lost 30 percent of their weight—all fat—in two weeks (above right). Human trials could begin next year.

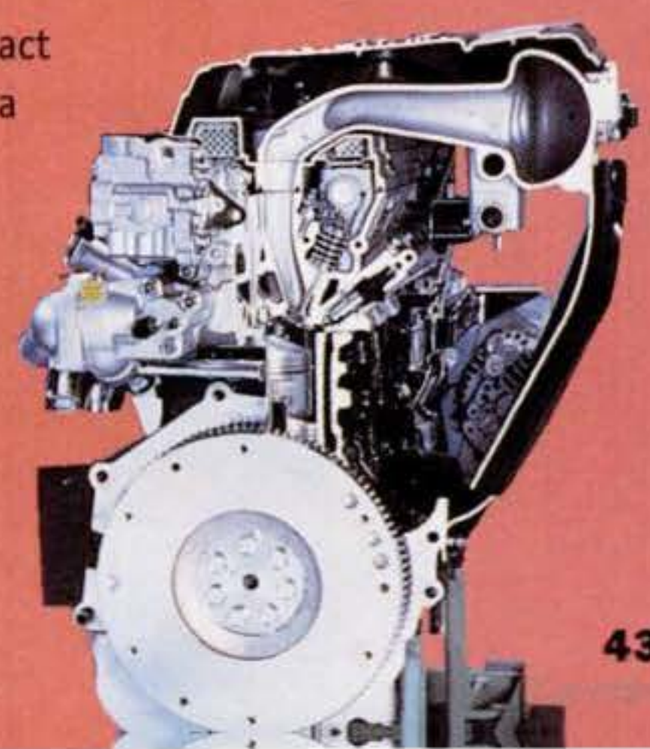
Master Cancer Gene Found

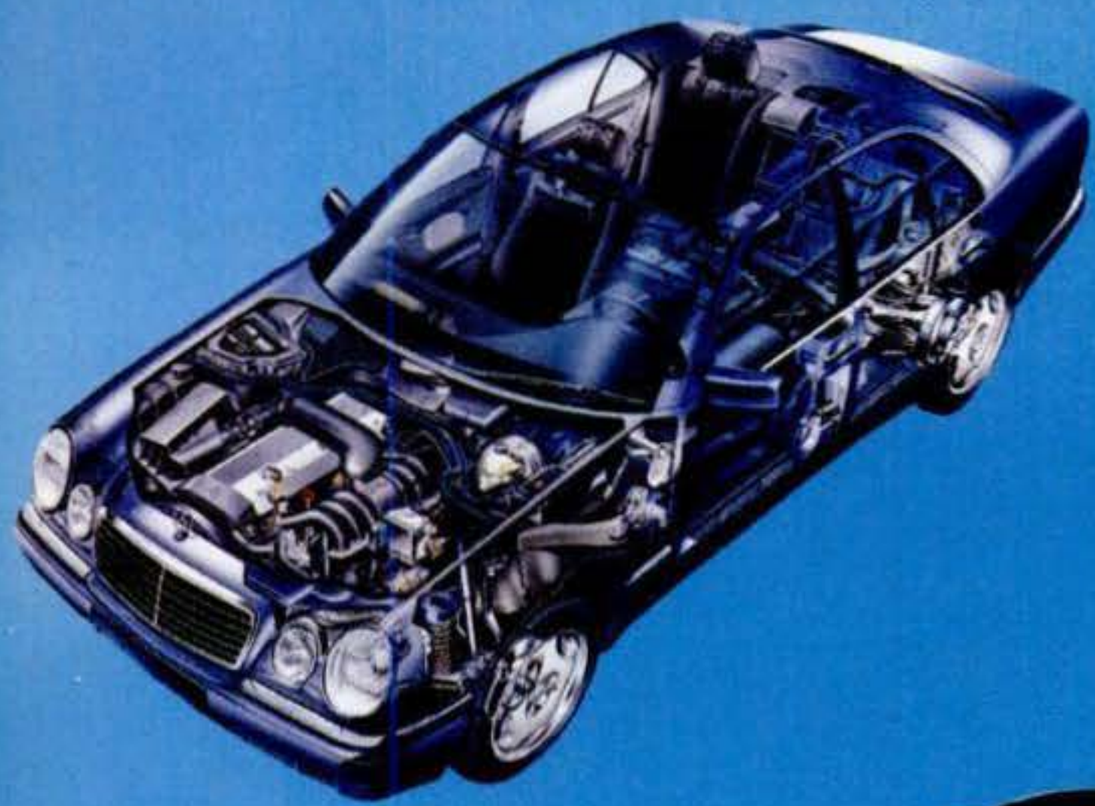


MEDICAL RESEARCHERS have isolated what may be the most important cancer-related gene, after a decade-long search. The defective gene, known as *ATM*, has been associated with cancers of the breast, colon, lung, stomach, pancreas, and skin. Moreover, it may be carried by more than two million Americans. Isolation of the gene could boost efforts to find ways of preventing cancer in susceptible people.

Going Direct

DIRECT injection of gasoline in the cylinders, at the exact moment in the combustion cycle when it is needed, is a highly efficient technique used in aircraft and racing-engine designs. But it has been attempted only rarely in small engines for conventional cars and trucks—until now. Taking engine design into a new era, Mitsubishi engineers have created a clean engine with 20 percent better mileage than conventional diesels. The option will add about $300 to the price of a car.





Engineered Luxury

MERCEDES' E-Class builds on one of the best-engineered luxury sedans in the world—while retaining the title for true opulence and solid construction. The E-Class adds interior space and some creature comforts that seem almost frivolous compared with past Mercedes models. One example is a new sensor that measures the air quality outdoors and then adjusts air-conditioning ducting accordingly. The price is not yet set.

Instant Ignition

IT'S ONE OF the most user-friendly features for outdoor power tools in years: Homelite's quick-start system for gas trimmers replaces the tedious yanking on an engine pull cord with the easy press of a lever and push of a button. The Electric Start mechanism uses a nickel-cadmium battery, which can start the engine 40 times before recharging. A 25cc Electric Start Plus trimmer costs about $185; attachments range from $29 to $109.

PATRICK LANDMANN

Ancient Tomb

OUR UNDERSTANDING of ancient Egyptian culture is taking another leap forward, thanks to the discovery of the remarkable tomb constructed by the great pharaoh Ramses II for his 52 sons. The mausoleum, dubbed Tomb 5, has 67 chambers, making it the largest and most complicated yet discovered. In the years ahead, the tomb should continue to shed light on the era: Team leader Kent Weeks, a professor at the American University in Cairo, says signs indicate there may even be a lower floor.

GRAND AWARD WINNER

AUTOMOTIVE TECHNOLOGY

Yaw Control

EVEN THE MOST expert driver can't quite match the performance of the ingenious anti-yaw control developed by Bosch Corp. If a wheel begins to spin due to slippery conditions or loss of control around a corner, the system applies the brake at the appropriate wheel—smoothly bringing the vehicle back under control. Available now in Europe, the system will be sold on the Mercedes E-Class by year's end. It will be standard on some models, and a $1,000 option on others.

Ancient Art Gallery

RADIOCARBON dating tests performed earlier this year prove that the breathtakingly beautiful artwork discovered by explorer Jean-Marie Chauvet in a French cave is the oldest in the world. The 30,000-year-old paintings and carvings are important for several reasons: They provide clear evidence that primitive artists possessed impressive creative skills; they supply clues about the lifestyles and surroundings of the people who created the art; and they offer accurate, detailed views of animal species that have since become extinct.

GAMMA LIAISON

Next-Dimension Camera

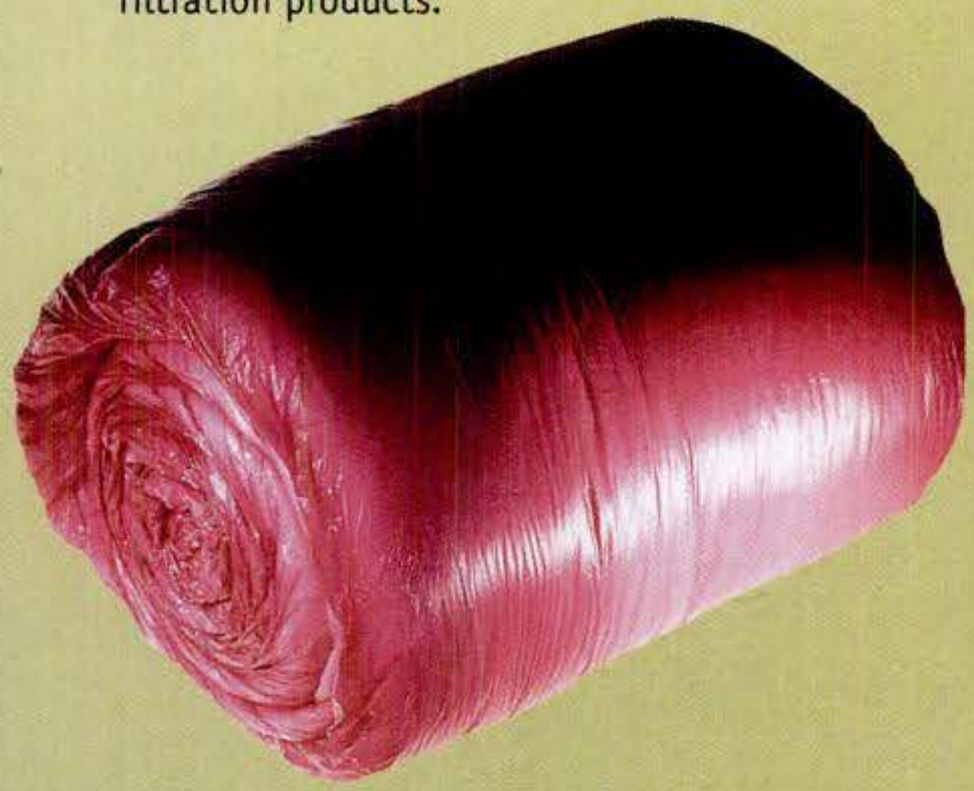
TAKE THE mechanical perfection, quiet operation, and suaveness of handling that made classic 35mm rangefinder cameras famous. Now bestow those qualities on a medium-format camera. You get the Mamiya 7, the only 6x7cm rangefinder with interchangeable lenses. The large, "ideal format" negative makes for superb enlargements to standard paper sizes without cropping. Four lenses, ranging from 43mm to 150mm, are available. List price for the body alone is $2,265.

The Itch Is Gone

THE BEST PART about Miraflex, the first new glass fiber in nearly 60 years: It won't make you itch. Owens-Corning fuses two different filaments to make the insulation. The soft fibers curl randomly, unlike conventional straight glass fibers. Tightly rolled and sealed in a polyethylene wrapper, Miraflex restores to its original loft when uncurled. At 8 3/4 inches thick, Miraflex has the same insulative value as conventional fiberglass, R-25. Other potential applications include fire-retardant fabrics and filtration products.

Infrared to Watch Over Me

MAKING imaginative use of inexpensive infrared emitter-detectors and microprocessors, SideMinder is a Siemens Corp. system that monitors the blind spot created by a car's roof pillars. Produced in high volume, the system would boost the lane-changing confidence of motorists for an added cost of about $50—much cheaper than being sideswiped. SideMinder may be offered on some 1999 vehicles.



For more information see RESOURCES on page 113.

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GRAND AWARD WINNER

ENVIRONMENTAL TECHNOLOGY

The Light Fantastic

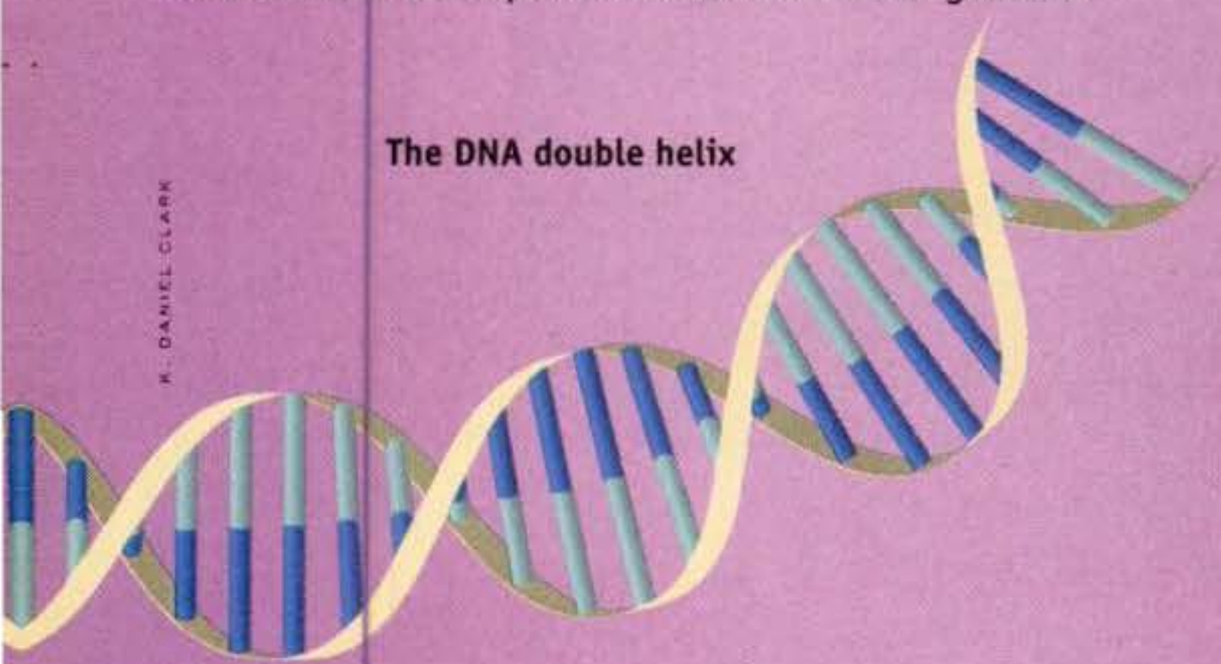
SOMETIMES, it's *bright* things that come in small packages: One Solar 1000 sulfur bulb's light output exceeds that of 90 100-watt incandescents—and consumes 25 to 50 percent less energy. Microwaves excite sulfur powder inside the bulb's hollow quartz sphere. The resulting glow resembles natural light, which is more aesthetically pleasing than that of many fluorescent or mercury-vapor bulbs. Developed by Fusion Lighting, the Solar 1000 will be sold this spring for large buildings, such as factories and shopping malls; price not yet set.

Heads-up Airbag

FRONTAL AIRBAGS are nearly universal, with side-impact airbags becoming more common. But what about protecting your head? For that, BMW adds a third airbag that deploys from a roof panel. BMW's approach provides one of the most sophisticated restraint systems introduced so far in the ongoing quest to lessen serious injuries in automobile crashes. The bag will be available in 1996; the price is not yet set.

First Complete Genome

FOR THE FIRST time, the complete genetic blueprint, or genome, of a free-living organism (as opposed to a virus) has been revealed. A team led by Craig Venter of the Institute for Genomic Research and Hamilton Smith of Johns Hopkins University deciphered the genome of the bacterium *Haemophilus influenzae*: the 1.8 million base sequence, a map of the genes' sites, and a list of many of their functions. The techniques used will help in the much more difficult attempt to uncover the human genome.



The DNA double helix

K. DANIEL CLARK

New Pacesetter

FROM CHRYSLER, the company that established the minivan genre, comes the first complete reworking of its most famous vehicle—and the result is a rousing success. Sold as Plymouth Voyager, Dodge Caravan (shown), and Chrysler Town & Country, the minivan sets new standards for styling, solid handling, low noise level, and smooth ride—while adding considerable interior room. Top that off with a new generation of powertrains, and you get a handsome and driveable minivan. Base price: $16,800.

For more information see RESOURCES on page 113.

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MAKE MILLIONS DOING IT.

YES, IT'S THE 80'S ALL OVER AGAIN.

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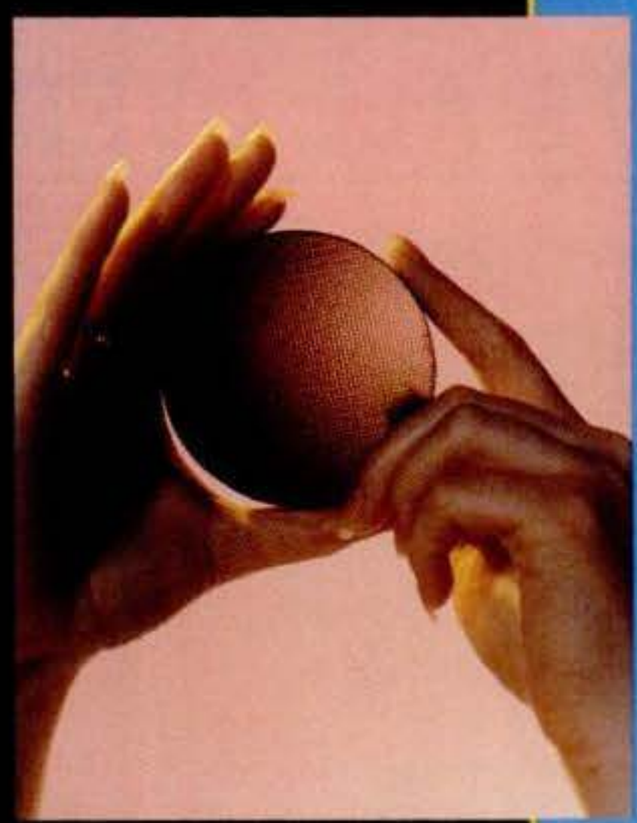
GRAND AWARD WINNER

HOME TECHNOLOGY

Converting a Killer



CARBON MONOXIDE detectors warn homeowners when levels of the deadly gas rise—but they don't combat the original problem. Now a prototype catalytic system from NASA's Langley Research Center converts carbon *monoxide* into harmless carbon *dioxide*. Originally developed for lasers that run on carbon dioxide, the device comprises a ceramic honeycomb coated with tin oxide and platinum (photo). A home version could hit the market by 1997 and should cost about $500.

Giant Step for Mankind

A LEG BONE and other fossils discovered by Meave Leakey of the National Museums of Kenya and Penn State professor Alan Walker have revealed a previously unknown species of human ancestor that lived about four million years ago. Named *Australopithecus anamensis*, the hominid walked on two legs—a key adaptation that separated our human ancestors from the apes. The Kenya discovery pushes the emergence of bipedalism back by about a half million years, and could help paleontologists determine when humans and apes diverged on the evolutionary tree.

Beyond Low Impact

A STINT ON the Sky Walker from Reebok and Sport Specific International could be described as race-walking on air; others call it "vertical swimming." By whatever name, the Sky Walker takes low-impact exercise all the way to no impact—especially beneficial for the knees and joints of older exercisers. You step into the arcing foot pads, grasp the poles, and begin a total-body gliding motion that can range from a shuffle to a gallop, depending on setting. Price: $3,495.

Triumphant Return

THE VENERABLE Triumph motorcycle marque is back, minus the dreaded electrical and oil-seeping faults that plagued British bikes of yore. Modern in every aspect, the new family of Triumphs is built around freshly designed three- and four-cylinder multivalve engines that pull like locomotives. Particularly endearing is the Speed Triple, an agile 900cc racer that elicits visceral, wind-in-the-face joy in the rider. It's great to see shapely new gas tanks wearing that lovely old logo.

New-Generation Diesel

THE DIESEL engine has long had theoretical benefits and practical drawbacks—mainly noise and poor emissions. Now lightweight, direct-injection, turbocharged diesels from Volkswagen run smoothly and offer ultralow emissions and extraordinary fuel efficiency. They are available in several VW models sold in the United States—where tight emission standards have otherwise virtually eliminated diesel engines in passenger cars. The option costs $700 to $900.

Suicide Mission

ON DECEMBER 7, a probe released from the unmanned *Galileo* spacecraft five months earlier will provide the first closeup look at the atmosphere of Jupiter, a gas giant that is our solar system's largest planet. As it plunges through Jupiter's atmosphere, the probe will relay data to the *Galileo* orbiter for about 75 minutes, before succumbing to the intense heat and pressure. Scientists expect the measurements to provide important clues about Jovian chemistry, winds, clouds, and lightning.

Let the Sunshine in

THE TYPICAL snapshooter takes pictures at family happenings and then stows the camera for months. At the next event . . . surprise! Dead batteries. Not anymore: Canon's Sure Shot del Sol is the world's first fully automatic solar-powered 35mm camera. Solar cells are built into the front lens cover; when the cover is opened, the camera activates and the cells generate power. A second battery stores surplus electricity and never needs replacing. The fully charged camera handles six to eight 24-exposure rolls of film. Price: $285.

Sturdy Luxury

RANGER ROVER'S "luxury" sport utility combines rugged off-road capability and interior details that pamper passengers. Its full traction control, full-time four-wheel drive, and ability to automatically adjust the height of the air suspension make the Range Rover 4.0 SE a most capable vehicle for heavy going. It also retains reasonable handling, despite its bulk—a rarity in sport utilities. Base price: $55,000.

For more information see RESOURCES on page 113.

GRAND AWARD WINNER

CARS

Follow the French Curve

FORD'S 1996 TAURUS and its sibling, the Mercury Sable, reinvent the mainstream family sedan. Headlamps, rear window, and even the car's cross-section follow the shape of an ellipse. The elliptical central control console makes it easier to get to the right switch the first time. New functional features include a fold-down rear seat and a front-passenger armrest that converts to a storage console or middle seat. The stiffer body structure and state-of-the-art 24-valve V6 also improve driving dynamics. Base price: $19,150.

Look, Ma, No Wires

NO NEED FOR special tape deck adapters or the bother of hooking up dangling cords every time you want to play camcorder tapes. Hitachi's VM-H81A Hi8 camcorder transmits audio and video via an infrared signal to your TV. You hook up an infrared receiver; then anytime you want to view a tape, you simply place the camcorder within 10 feet of the receiver and hit "play." Price: about $2,100.

Playing with the Best

SONY'S PLAYSTATION (price: $299) is the best video-game platform you can get for the home. Performance is snappier than anything we've seen; the rendering is more detailed; and the perspectives from above, below, behind, or to the side of the action figures change constantly. Games with race-car rallies and martial-arts tournaments, in particular, approach arcade quality.

Outta Line

ROLLERBALL International has taken the line out of inline skating. Instead of a row of flat-sided wheels, patented Rollerball In-line Radial skates have one spherical wheel at the heel and another at the toe. These unique wheels increase balance, maneuverability, and control. Prices range from $60 to $120.

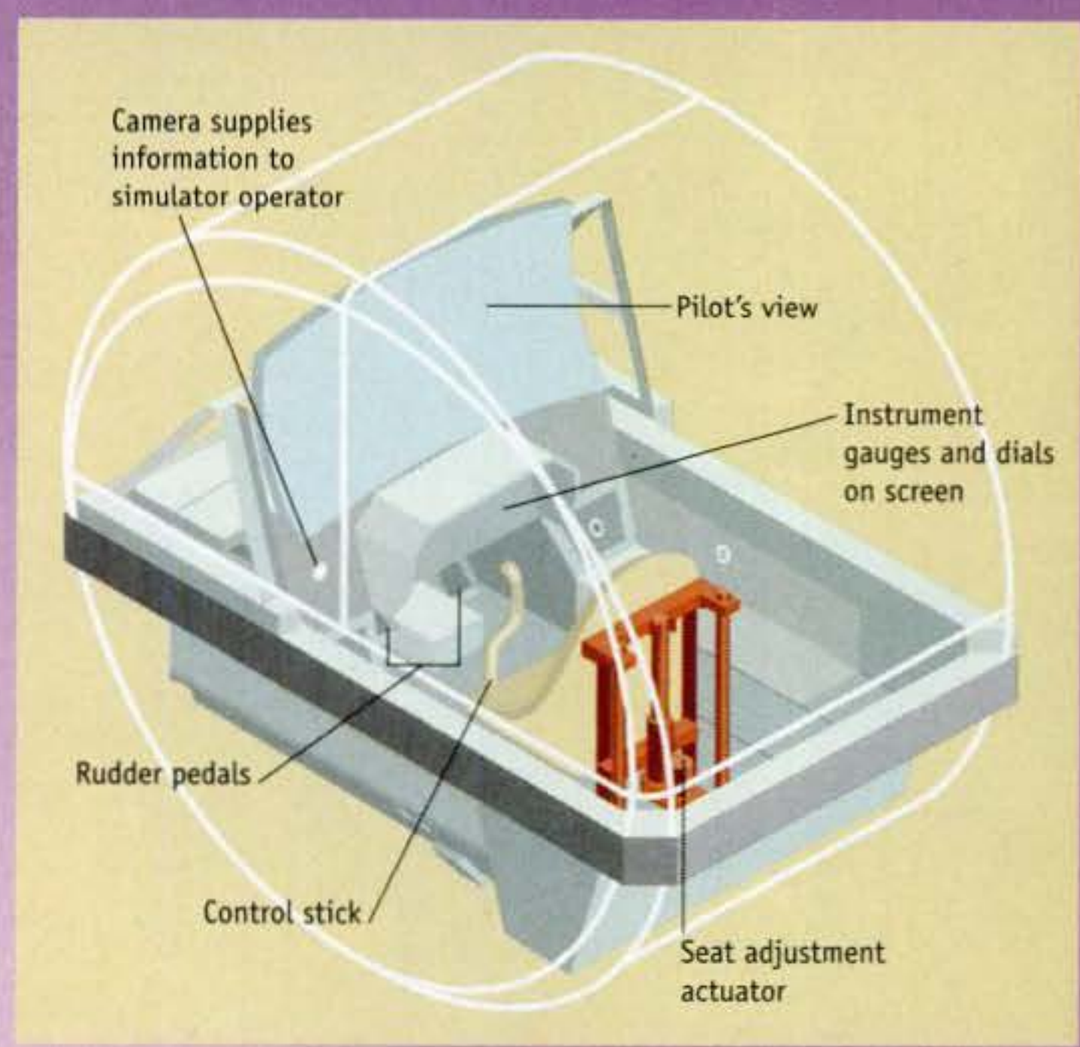
For more information see RESOURCES on page 113.

One-Stop Surfing

NO MORE fiddling with rabbit ears that can't accurately tune more than a few TV channels at one position: MegaWave's set-top antenna, due out in 1996, clearly captures an unprecedentedly wide range of signals, from 50 megahertz to 1.25 gigahertz—automatically. That means it can tune channels 2 through 68 equally well from one position. Based on technology developed for the Defense Department's Advanced Research Projects Agency, the antenna was designed with specifications from the National Association of Broadcasters.

Straighten up and Fly Right

MILITARY PILOTS sometimes begin to wonder which way is up, particularly when flying through clouds or at night. The Advanced Spatial Disorientation Demonstrator at Brooks Air Force Base in Texas is a simulator that combines computer graphics with subtle, 360-degree motion to give new pilots a safe taste of what it's like to lose their sense of where the horizon is. The lesson: When in doubt, keep your head still and trust the instruments.



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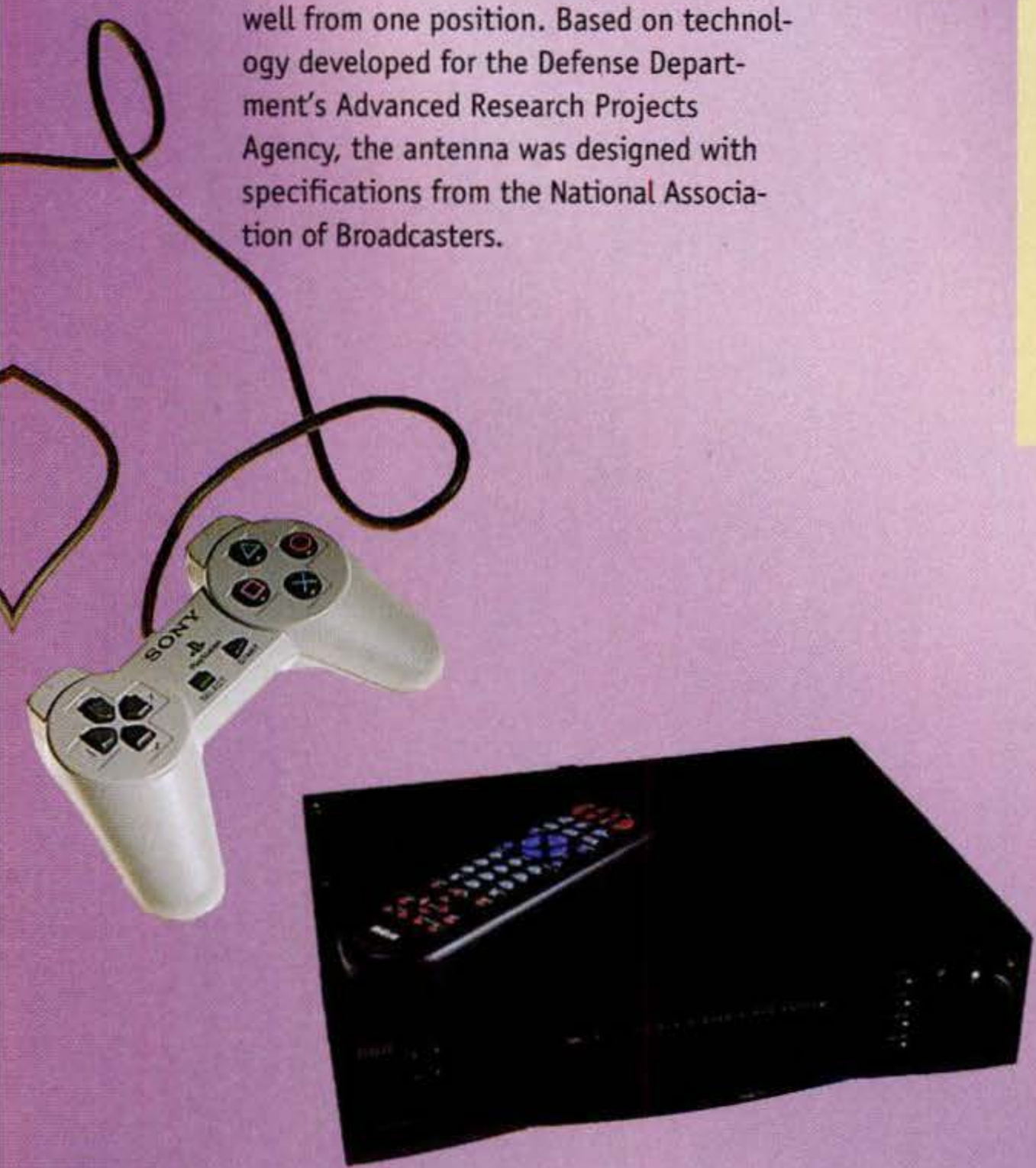

Not Just Skin Deep

THE LEICA Minilux is the epitome of luxury, with a sleek leather-trimmed titanium body. But its virtues go far deeper. For starters, the high-class 40mm f/2.4 Summarit lens is the fastest in this category of 35mm camera. And the Minilux has a choice of automatic or manual focusing *and* a choice of programmed or aperture-priority modes, giving the photographer four different ways to shoot. Multimode flash and exposure compensation complete the amenities. Price: $995.

Not a Word from Our Sponsor

THE FIRST VCR that enables viewers to bypass commercials will wow anyone who gets antsy during station breaks. Two models of RCA VCRs (including the hi-fi VR678HF shown) from Thomson Consumer Electronics analyze a tape, and then on playback automatically scan past the commercials while showing a therapeutic-blue screen [see Electronics Newsfront, this issue].

INTRODUCING THE FIRST
COMPLETE LINE OF LIGHTING TOOLS
BUILT SPECIFICALLY FOR THE

DEMANDS OF PROFESSIONAL
TRADESMEN. THEY'RE TOUGH.
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Laid-Back Hardtop

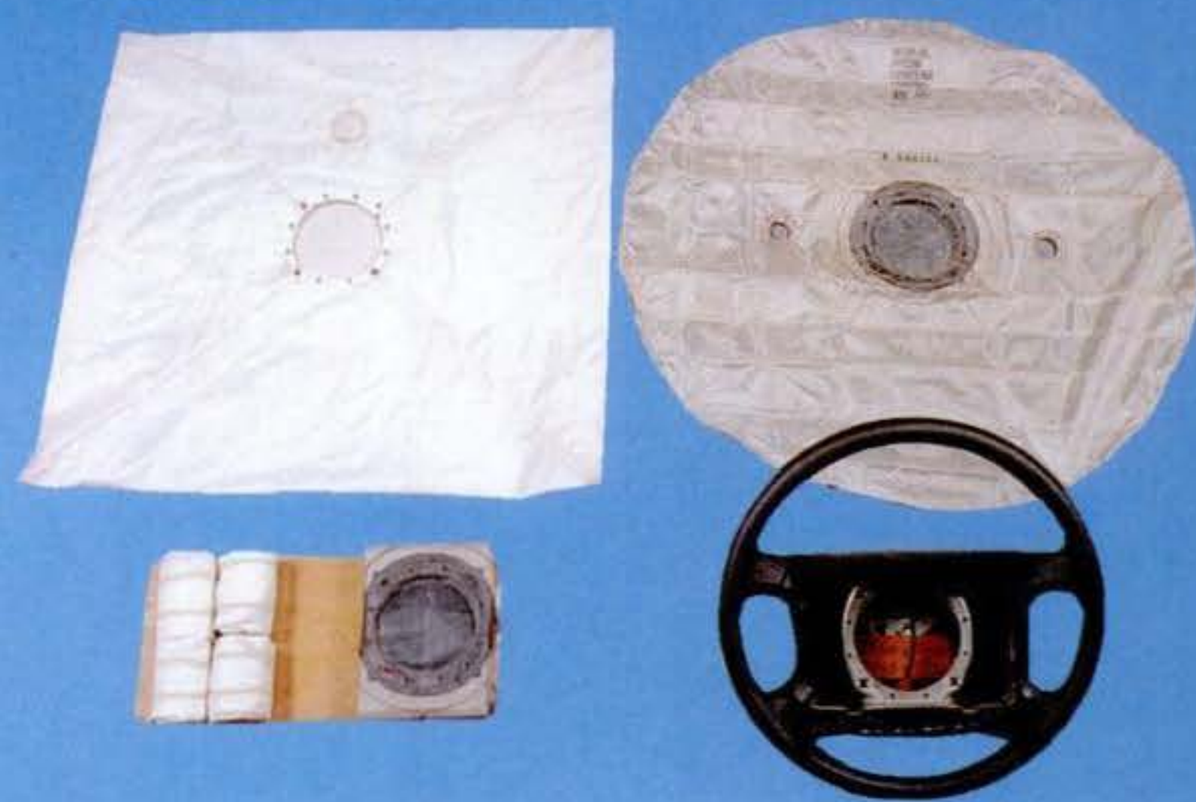
MANY HAVE TRIED to create a *true* hardtop convertible, one with a metal roof that folds away in the rear for open-air motoring. But none has been as successful as Mitsubishi. The 3000GT Spyder has an ingenious arrangement of levers and metal that make up its folding top. When you touch a console button, the side windows open automatically and the top folds neatly into the trunk. Base price: $57,500.

Shakeless Zoom Telephoto

APPLYING technology previously implemented in its camcorders and binoculars, Canon has introduced the world's first image-stabilized interchangeable lens for a 35mm SLR. The EF 75-300mm f/4.5–5.6IS USM lens uses gyro sensors and a 16-bit microcomputer to sense and counteract blur-causing vibration. Result: A photographer can hand-hold the camera at shutter speeds two stops slower than normal—for example, 1/60 second rather than 1/250 second at 200mm. Price is $920.

The Everything Camera

THE POCKET-SIZE Casio QV-10 is the first digital camera with an LCD screen for viewing pictures already in the camera or pictures about to be taken. It also has ports for a computer and TV. You can enlarge stored pictures on the viewer or delete them on the fly. The $899 camera holds 96 color stills. The QV-10 also works as a portable presentation device; images you download from a computer to the camera can be displayed on TV or copied to videotape for a slide show.



Meet the Mini Airbag

WHILE A REGULAR airbag (above right) hogs the space of two videocassettes, the prototype Precision Technology Airbag developed by Sandia National Lab and Precision Fabrics Group fits in a shirt pocket (four are rolled, above left). That means automakers can install more airbags in cars—in door panels and in seats, for example—offering their protection in side impacts and, for the first time, to rear passengers. The mini airbags could be sold on 1997 or '98 model cars and should cost about the same as conventional airbags.

For more information see RESOURCES on page 113.

Bartenders in elf hats.

Disco Christmas carols.

Red & green clam dip.

Not tonight.

The most popular whisky in the American home.

Imported and Bottled by Brown-Forman Beverages Worldwide. Canadian Whisky. A Blend. 40% Alc. by Volume. Louisville, KY. ©1995

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To the Rescue

RESCUERS AT the tragic Oklahoma federal-building bombing had a powerful and portable new tool for extricating victims. Called the LifeShear Cutter, the tool incorporates technology developed for NASA space missions. Like a shotgun shell, its pyrotechnic power unit punches a blade through metal such as rebar or car roof posts. Designed by Hi-Shear Technology Corp. and the Torrance, California, fire department, LifeShear comes in 8.5- and 11.5-pound models—some 70 percent lighter than conventional hydraulic rescue equipment. Cost (for either): $1,750.

Handle with Flair

THE SANYO MDC-2000 is the first all-in-one boom box that combines a cassette recorder/player, a compact disc player, and a Mini Disc recorder/player. One-touch synchronized dubbing simplifies recording to a cassette from a CD. A record-editing feature lets you tailor the order of tracks made from a CD to an MD. Also included are an AM/FM tuner, dual cone speakers, bass-enhancement, a fluorescent display, spectrum analyzer, and remote. Price: about $1,000.

GRAND AWARD WINNER

RECREATION

Smooth Lifting

CONVENTIONAL stacked-weight machines require different amounts of strength at varying points during the lift (or press)—creating a herky-jerky motion that could spell injury. But the Enforcer's nitrogen-gas-charged pneumatic cylinder delivers consistent true-weight resistance throughout an entire lift or press. To adjust the weight or leverage angle for different exercises, you simply move a bar, and spin a holding disk into place. Home and professional models will sell this summer and cost some $600 to $1,200.

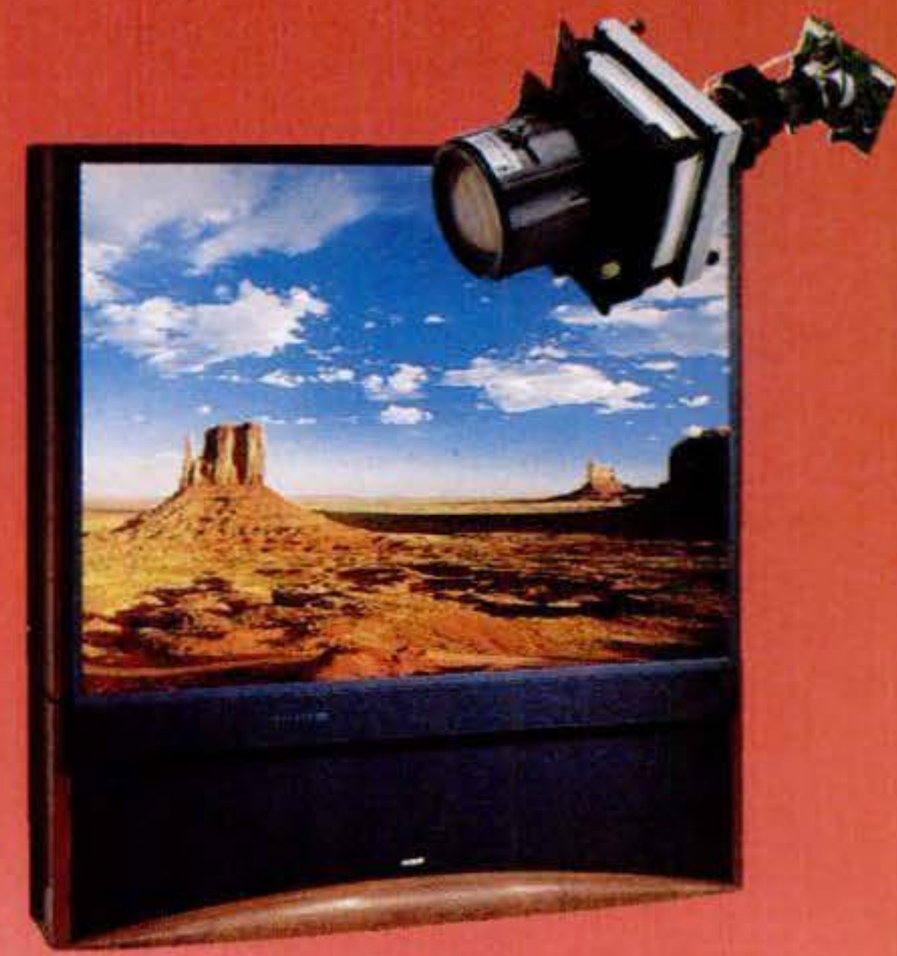
TV on a Rope

EXPRESSING yourself just got easier: You can jump and scream at a ball game with both arms waving—and not drop your portable TV. How? The Straptenna built into the Sony Watchman FDL-22 hangs comfortably around your neck—and provides reception to boot. The 2.2-inch color LCD screen with built-in speaker scans for all VHF and UHF stations. The $160 TV weighs 10 ounces (with four AA batteries).

For more information see RESOURCES on page 113.

Vials of Power

EVEN AVERAGE players can boom powerful serves and returns with wide-body tennis rackets. But their downside is less precision, and extra vibration that can cause tennis elbow. ProKennex's clever Kinetic racket counters these problems: The kinetic energy from 100 tiny vials of metal powder in the racket's frame reduces the twisting normally produced by an off-center hit, forcing a truer strike while dampening vibration. Price: $250.

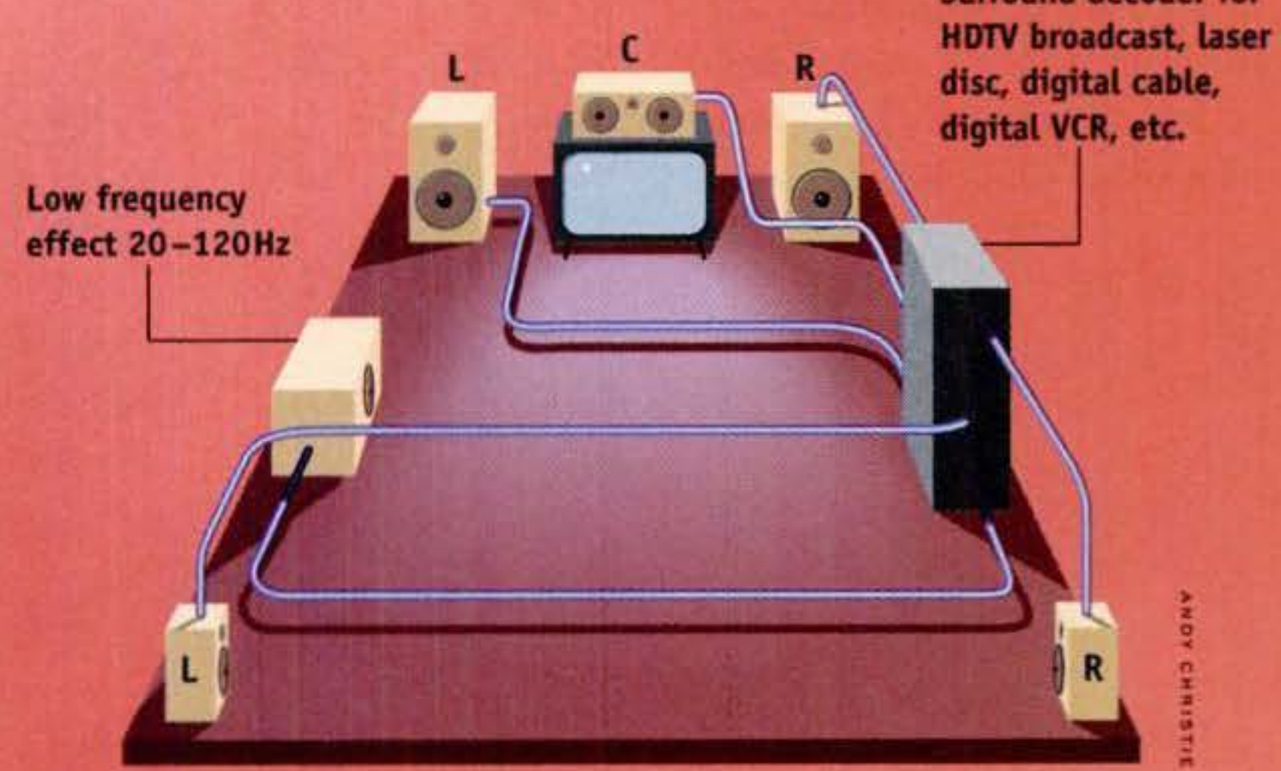


Bigger Is Better

REAR-PROJECTION TVs use three projected beams (red, green, and blue) that converge on the back side of the screen. Now Thomson Consumer Electronics has introduced three RCA ProScan sets that use 9-inch tubes—28 percent larger than the industry standard 7-inch tubes. The largest is the PS80690, the first 80-inch-diagonal screen TV ($8,499). It's big, it's bright, and it looks terrific.

In Through the Third Door

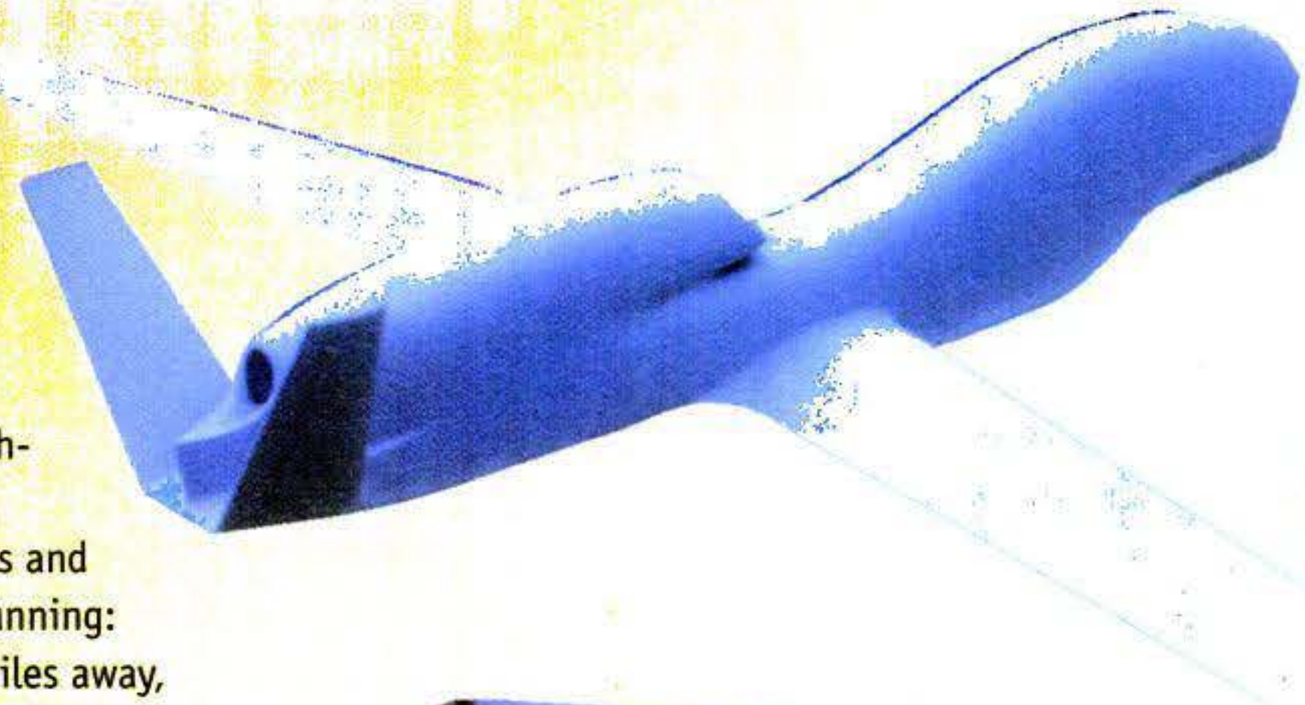
IF YOU BUY an extended cab to haul more cargo, you need better access to the rear seat. That simple idea has been ignored by truck manufacturers for years. Now Chevrolet makes it easier to load people and baggage with a door that swings out, expanding the opening to the rear. Available as an option on various Chevy and GMC C/K, Sierra, S-Series, and Sonoma models, the panel will likely become standard in the near future.



Next Wave of Video Sound

DOLBY PRO LOGIC, today's home-theater audio standard, extracts multichannel information only from stereo tracks. But the best way to reproduce *true* movie-theater sound at home is Dolby Labs' AC-3. It uses 5.1 discrete audio channels for left, center, right, left rear, and right rear speakers. (The ".1" represents a low-frequency subwoofer.) You can hear the difference now on a few dozen movies on laser disc, using an AC-3-equipped receiver from such manufacturers as Pioneer, Yamaha, and EAD. AC-3 will also be on digital videodiscs next year, and on HDTV in the future.

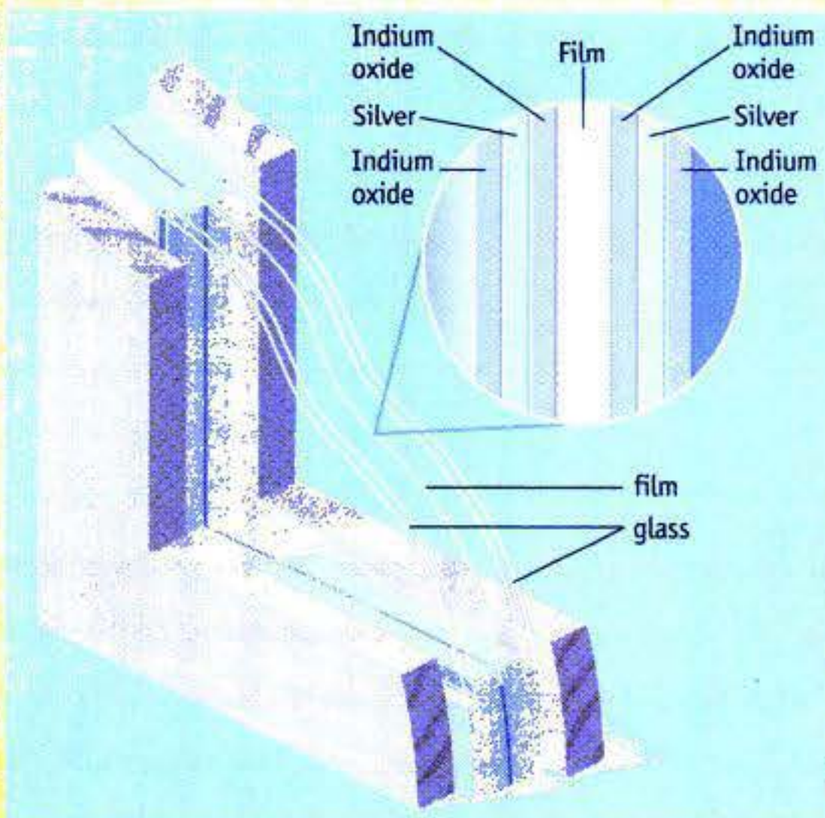
The Persistent Drone



TELEDYNE RYAN'S Tier II Plus is an aerial spy robot intended to overfly relatively lightly defended areas, simultaneously taking pictures with three acute sensors: synthetic aperture radar, infrared, and high-resolution video. Onboard self-protection systems including electronic radar jammers and towed decoys will help it survive. Most stunning: The drone can fly to a target area 3,400 miles away, loiter overhead for 24 hours, then return home.

Twice As Nice

FROM THE INVENTORS of the energy-saving clear polyester film used in windows comes the next generation: Southwall Technology's TC-88 film is the first coated on *both* sides with optical-control materials, of indium oxide and silver. Substituting TC-88 for the old film in an argon-gas-filled window boosts the resistance to heat flow from R-4.0 to R-6.3. Better yet: Manufacturers such as Hurd sell windows with TC-88 for the same price as those with older film, about $35 to $42 per square foot.



K. DANIEL CLARK

Let's See That Again

A NEW LINE of 27- and 32-inch TV sets from Magnavox lets you direct the sportscast: They can replay the last four or eight seconds of a game on command. Instant Replay TVs have solid-state memory devices that keep anything you just watched ready for immediate review. The replay is displayed in a picture-in-picture window. Of course, the feature is not limited to sports. Want to see that phone number or recipe again? Just reach for the remote.

Total Immersion

NINTENDO'S Virtual Boy is the first 3-D 32-bit video gaming system. What does that mean? Press your face against the binocular-like table-top display, and you quickly become sucked into a 3-D red-on-black world of boxing, pinball, or other games. Two Virtual Boys can be cabled together for two-player tennis and other games. The $180 Virtual Boy platform runs on six AA batteries.

For more information see RESOURCES on page 113.

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Introducing the ES5000 with the world's first Eye Control System.

First it catches your eye, then it tracks it. It's the sleek new Canon ES5000. The only camcorder that offers an autofocus system and special functions that are solely controlled by the movement of your eye.

To operate the ES5000's Eye Controlled Focus, simply look through the viewfinder, direct your eye to any subject within the frame, and the camcorder automatically focuses there. Redirect your eye somewhere else within the frame and instantly the camcorder refocuses at the new position. Never before has autofocusing been smoother or simpler. With the ES5000 what you see is literally what you shoot.

Canon's new Eye Controlled Focus is operated by the movement of your eye.

Other ES5000 functions can be activated through our exclusive Eye Control technology as well. You can start and stop recording, display dates and titles, fade, operate digital effects and more, all with just a glance.

But there's more to the ES5000 than just what meets the eye. Consider its many other sophisticated features. Like a powerful 20x Optical/40x Digital Zoom, Canon's renowned Optical Image Stabilization system, a Super-High Resolution 180,000-pixel Color Viewfinder, and a high-quality Hi8 format for truly professional results. Add to all that its sleek, ergonomic, metallic design and you begin to see why the super-compact ES5000 is the biggest news in camcorders today.

For more information on the ES5000, simply call us at 1-800-OK-CANON. We're sure you'll find it to be an eye-opening experience.

Canon

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The Next Generation

THE NEW generation of Saturn sedans and wagons at last lives up to the original promise: low-cost cars with stylistic flair. The thermoplastic body is stiff and squeak-free, the suspension is compliant, and the engine is smooth and quiet. The cars are further enhanced by their durability—thanks to construction that is corrosion-proof and easily repaired. Prices start at $10,500.

Now Hear This

EXPERIENCING multimedia on the World Wide Web used to mean waiting around while you downloaded audio and video clips, and then playing them back afterward. Now Progressive Networks' RealAudio Player produces audio in real time—no downloading necessary—for immediate sound gratification. The software delivers live feeds or pre-encoded materials and is used by Web browsers such as Netscape.

Card Equals Cash

VISA'S STORED VALUE Cards eliminate the need for small change. A chip embedded in the plastic card tracks the amount of available cash for transactions, which you can access with a reader. Once the money runs out, you simply reload it with funds from your bank account. The cards will be used at the 1996 Olympic Games in Atlanta.

Seafaring Launch Pad

SEA LAUNCH is a self-propelled floating rocket base being built by Boeing Commercial Space Co. and Norwegian shipbuilder Kvaerner Group. Sea Launch will steam along with a support ship to the most efficient Pacific Ocean location from which to boost a satellite into the desired orbit. Then reliable and affordable rocket stages built by Russian and Ukrainian makers RSC Energia and NPO-Yuzhnoye will loft the payloads into space.

Keep an Eye on It

THE EYE IS quicker than the hand—when it comes to adjusting the focal box on your camcorder. Canon's ES5000 Eye Control Camcorder lets you assign functions to be eye-activated, including focus shifting and effects like quick zoom, fade to black, and picture mosaic. The $2,200 camera also features a zoom lens that is 20x optical and can be enhanced to 40x digitally; a rechargeable lithium-ion battery; and optical image stabilization to reduce blur.

GRAND AWARD WINNER

AUDIO & VIDEO

The Next CD

THE HIGH-DENSITY CD is poised to do for movies and computer games what the audio compact disc did for music—and then some. The same size as music CDs, these will be spacious enough to hold a feature-length film (about 135 minutes) with digital picture and sound quality. They will also hold about 9 gigabytes of data, promising a new generation of slicker CD-ROMs packed with more audio and video clips. Now that the two groups pushing the concept—one using technology chiefly from Toshiba and the other based on designs mainly from Sony and Philips—have agreed to develop a common format, we should begin seeing new players and titles sometime next year.

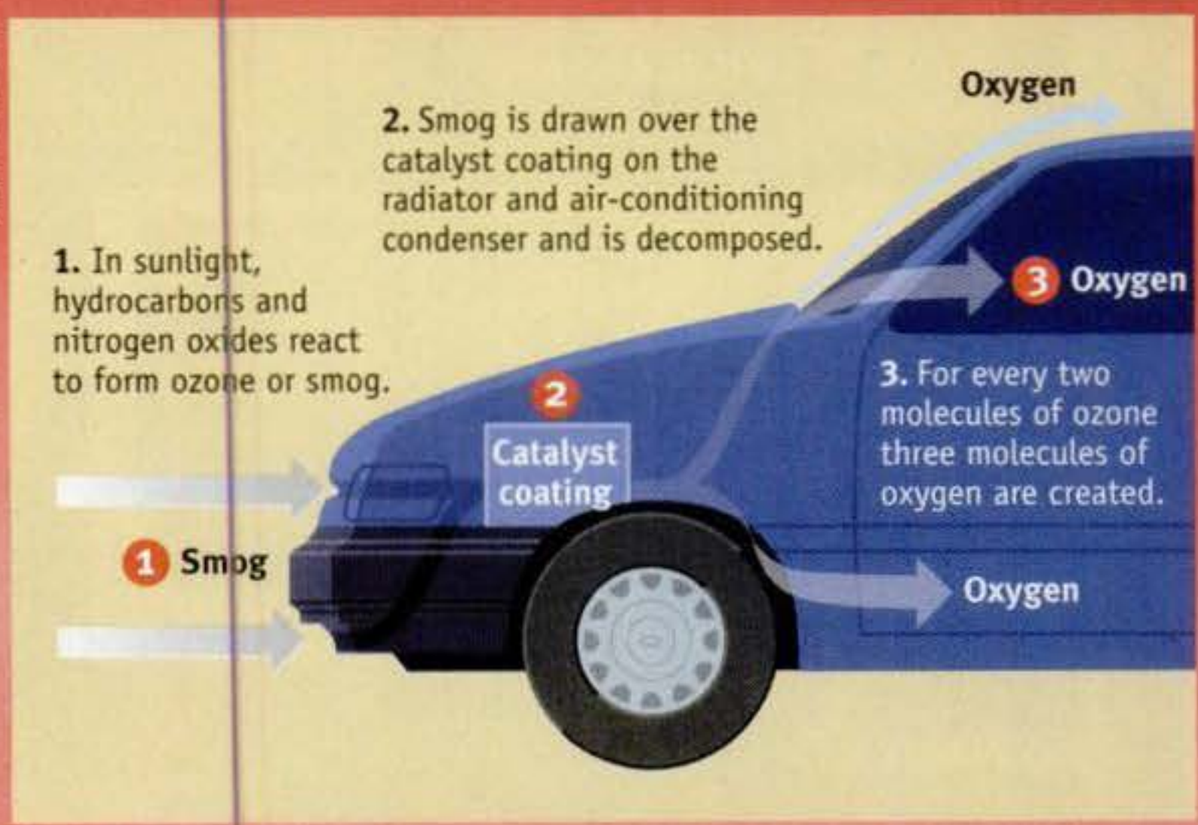
Like a Ghost

THE NATURE OF military operations will be transformed by unmanned spycraft like the Lockheed-Martin/Boeing DarkStar drone, which can gather images of a large area of terrain around a battlefield and relay it to local commanders in real time. Capable of flying 1,000 miles from its base to a target area defended by hostile missiles and fighter aircraft, the stealthy 69-foot-wingspan DarkStar can autonomously complete entire missions—including a runway takeoff and landing—under computer control.

Now, Here's the Skinny

YOU CAN'T GET much slimmer than the Ricoh R-1, a 35mm point-and-shoot camera that embodies the word "compact": The lens barrel retracts entirely, so the body is only an inch thick except for the hand grip, where the film cartridge is stored. For further space saving, the flash and control circuits occupy a single board. An unusual lens system houses a 24mm super-wide lens for panorama mode, and a 30mm lens for both panorama and normal modes. Price: $300.

For more information see RESOURCES on page 113.



GREG WAHARASHI

Smog Scrubber

AN EXPERIMENTAL new catalytic technology developed by Engelhard Corp. would actually let you *clean* air while you drive. As a radiator heats up, the PremAir platinum-based coating converts up to 90 percent of the smog-forming ozone and carbon monoxide it contacts into oxygen and carbon dioxide. Ford will soon test the system in 30 cars in nine countries. PremAir could be on the market by 1998 and may add less than $1,000 to a car's total price.

Affordable Infrared Imaging

THOSE GULF WAR pictures of stealth attack planes precision-bombing Iraqi bunkers were nighttime images taken with expensive cryogenically cooled infrared sensors that "see" heat. After laboring for 18 years, researchers at Hughes Industrial Electronics Co. and Texas Instruments created a breakthrough thermal-imaging system that functions at room temperature. Police departments and coastal patrols may benefit from the Texas Instruments NightSight, which will sell this summer for $8,000—one-tenth the cost of a conventional cryogenic sensor.

Expansive Telephoto

LOOK THROUGH a camera with a long telephoto lens, and the world takes on a different appearance—one that can make a photograph a "stopper." Tamron's f/5.6 zoom 200–400mm telephoto covers a range that begins where many zoomers leave off, one that is ideal for nature, sports, or other action photography. Its aperture is also fast enough for action-stopping shutter speeds. Low-dispersion glass elements (two of 13) reduce sharpness-destroying chromatic aberration. Price: $962.

Street Savvy

MAKING A FLAT-OUT race car palatable for the street is no easy task. But the Porsche Turbo manages quite nicely, thank you. While a typical race car engine fumbles below high rpm, Porsche's 440-horsepower twin-turbo version of its "boxer" air-cooled engine feels almost refined—despite its explosive performance potential. The base price—if you have to ask—is $99,000.

For more information see RESOURCES on page 113.

7.2V
MULTI-PURPOSE
SAW

7.2V DETAIL SANDER

7.2V HAND VAC

7.2V
VARIABLE-SPEED
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3.6V SCREWDRIVER

ADD TO YOUR TOOL COLLECTION, NOT YOUR BATTERY COLLECTION.

Introducing VersaPak™ from Black & Decker. Ingeniously designed cordless tools, all powered by interchangeable batteries. So you don't have to buy new batteries and a charger every time you buy a new tool, which saves you money in the long run. To learn more about VersaPak, please call 1-800-762-6672.

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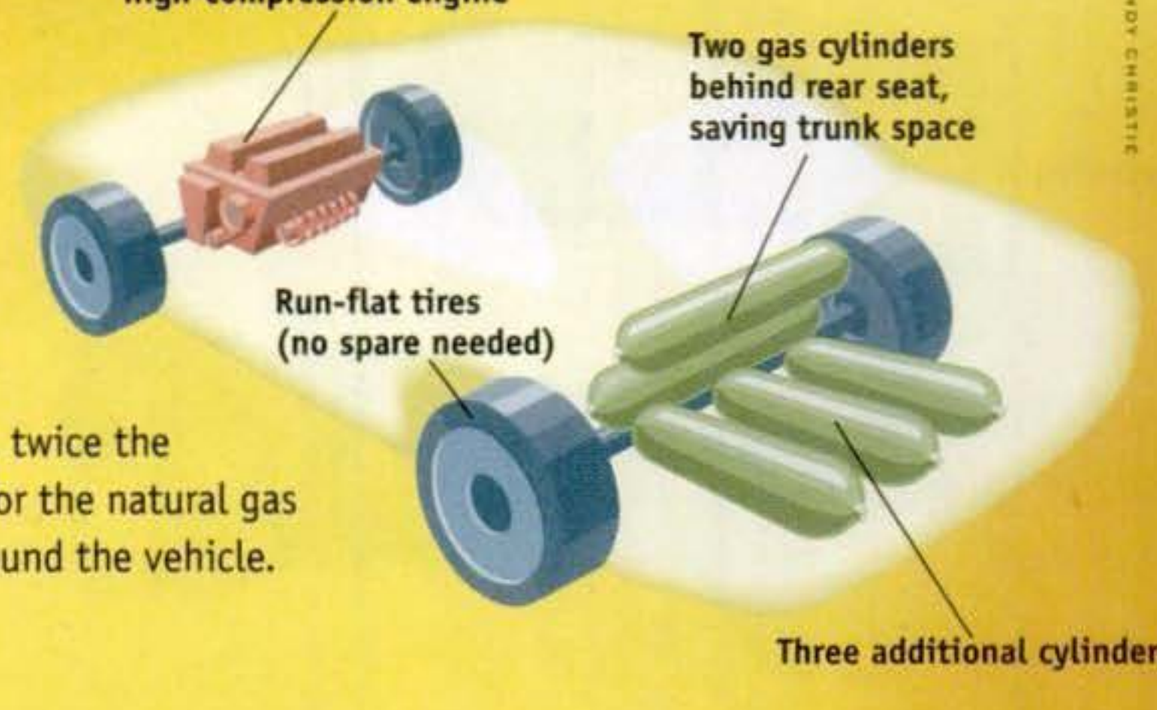
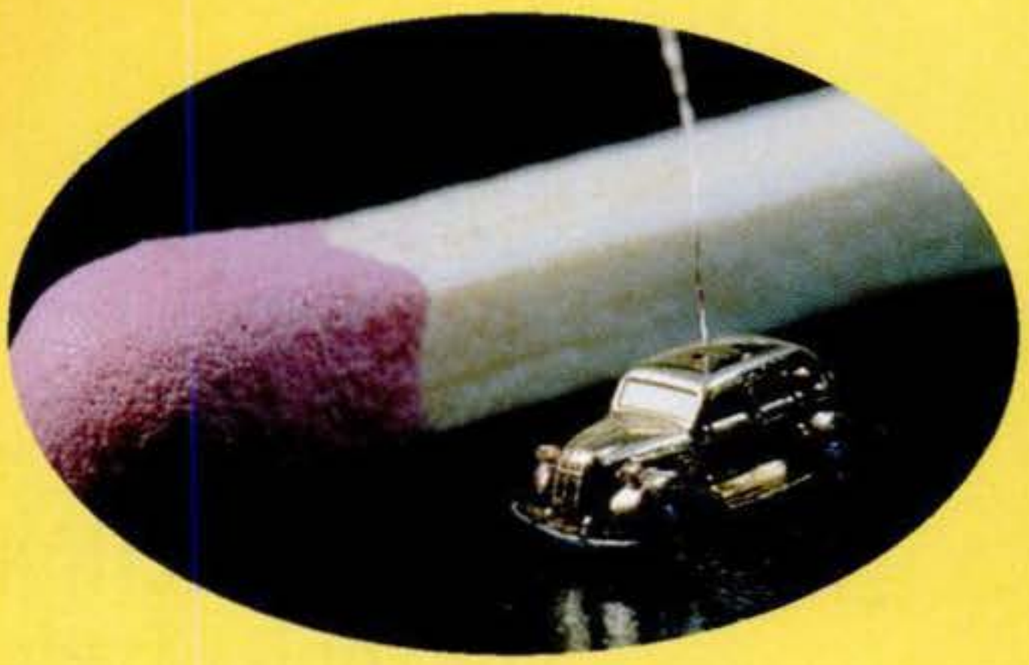
Driving with Gas Now

THE MASS APPEAL of clean-burning natural-gas vehicles is hindered by a simple fact: You can't go to the local station for a refill. Now the Advanced Natural Gas Vehicle, based on a modified Geo Prism, brings the technology an important step forward—it travels 300 miles on one refill, twice the distance of previous offerings. The five storage cylinders for the natural gas are also arrayed in a clever space-saving configuration around the vehicle.



ANDY CHRISTIE

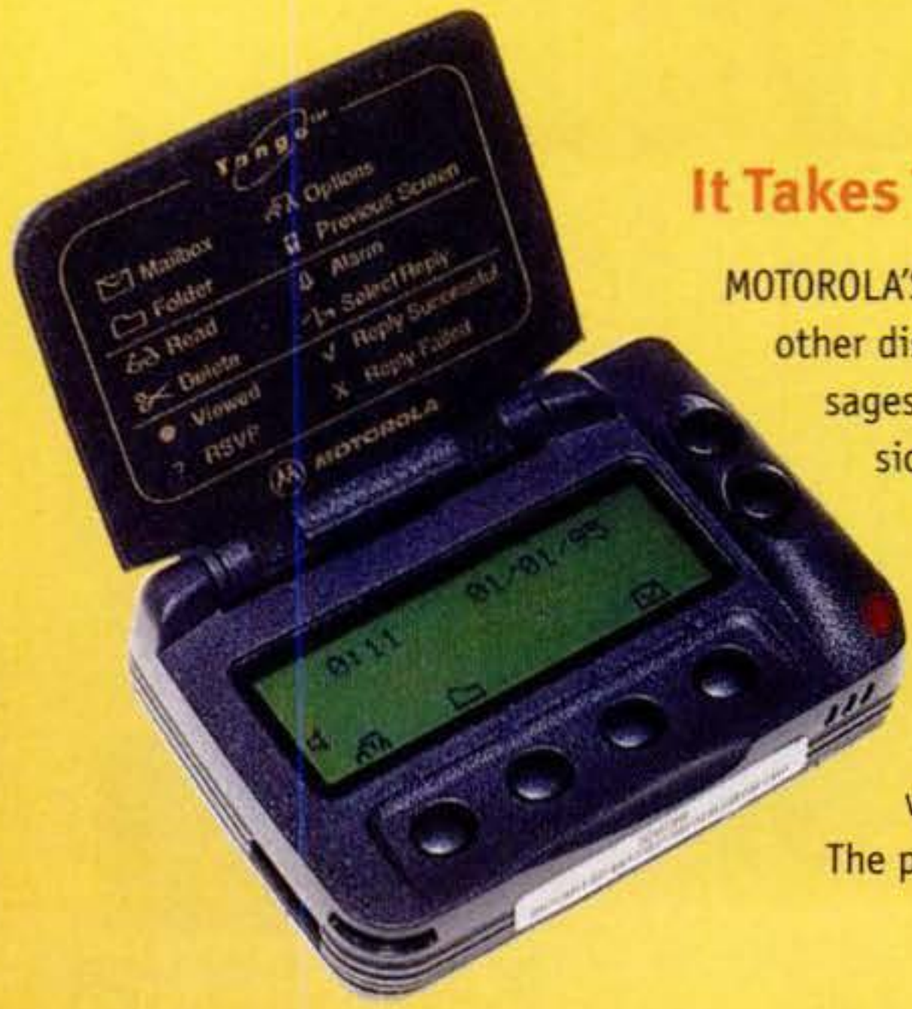


A Real Compact Car

REPRESENTING a step toward a future of useful micromachines, Nippondenso's Micro-Car is the world's smallest car—and it runs. At 4.78mm, it's about the size of a grain of rice. A 1/1,000-scale replica of the 1936 Toyota Model AA sedan, the front-wheel-drive Micro-Car is powered by a three-volt 0.67mm electric motor with just five moving parts. The motor includes a coil that uses 1,000 turns of wire.

Climb Through Skies

TIME FLIES when you're working out on VR Climber, a stair machine that displays a virtual world of planes you can race against, balloons, even UFOs. As you pump harder, you "fly" higher and faster through the onscreen sky, while you feel a breeze against your face from the built-in fan. The $7,000 VR Climber will be available for use in health clubs by year's end.



It Takes Two to . . .

MOTOROLA'S TANGO is the first two-way pager. Unlike other display pagers, it can receive and *return* messages using Motorola's Reflex two-way transmission protocol, which adds a response channel to traditional paging systems. You can select from 120 preprogrammed responses ("Please call," etc.). The message sender can call the paging service for responses, or see them on his own Tango. Tango will work first on Skytel's 2-Way paging network. The pager's cost will vary with service options.

For more information see RESOURCES on page 113.

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GRAND AWARD WINNER

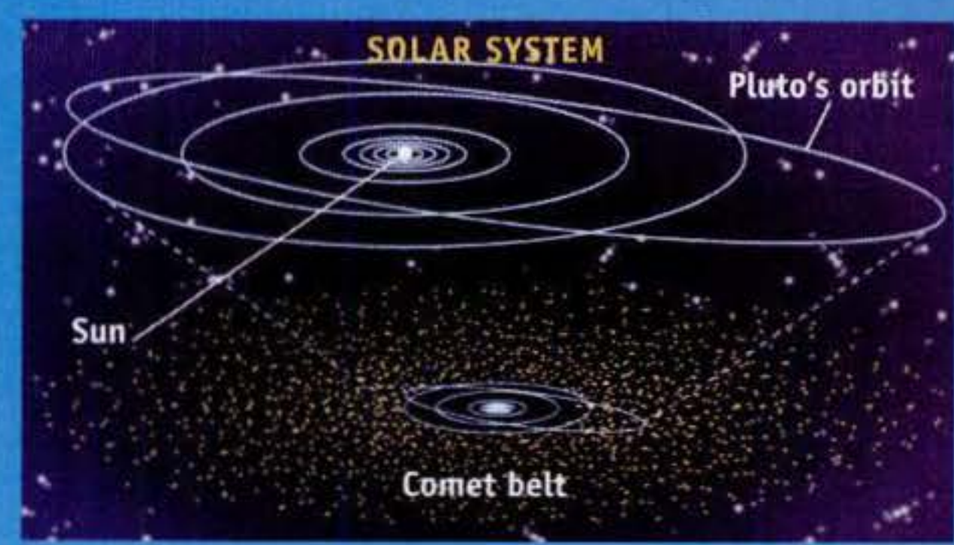
PHOTOGRAPHY

Zoom Fisheye

THE VIEW from inside a goldfish bowl captures 180 degrees of the scene and has the weird curvature of straight lines that is characteristic of those arresting photos made with fisheye lenses. Now Pentax has produced the world's first autofocus *zoom* fisheye. The SMC-F Fisheye Zoom f/3.5-f.4.5 zips from a 180-degree 17mm fisheye to a 90-degree 28mm wide-angle lens, a combination representing a remarkable feat of optical design. Price: $743.

Comet Birthplace

WHERE DO comets come from? A team of astronomers using the Hubble Space Telescope has detected a long-sought population of comets flitting around at the icy fringe of our solar system in an area named the Kuiper Belt. This, says the team, is the astronomical equivalent of finding the needle in the haystack. It also bolsters proof of a primordial comet reservoir just beyond the edge of our solar system.



K. DANIEL CLARK

Quick Fix for Loose Chains

ANYTIME YOU use a chainsaw, you have to stop periodically to tighten the chain. In the woods, the tightening tool—a screwdriver or wrench, depending on the type of chainsaw—is easily misplaced. Stihl solves the problem with its built-in Quick Chain Adjuster on its $400 023C model. The clever new device, a simple thumb wheel that rotates to adjust chain tension, also prevents inexperienced users from overtightening the chain.

Leader of the Pack

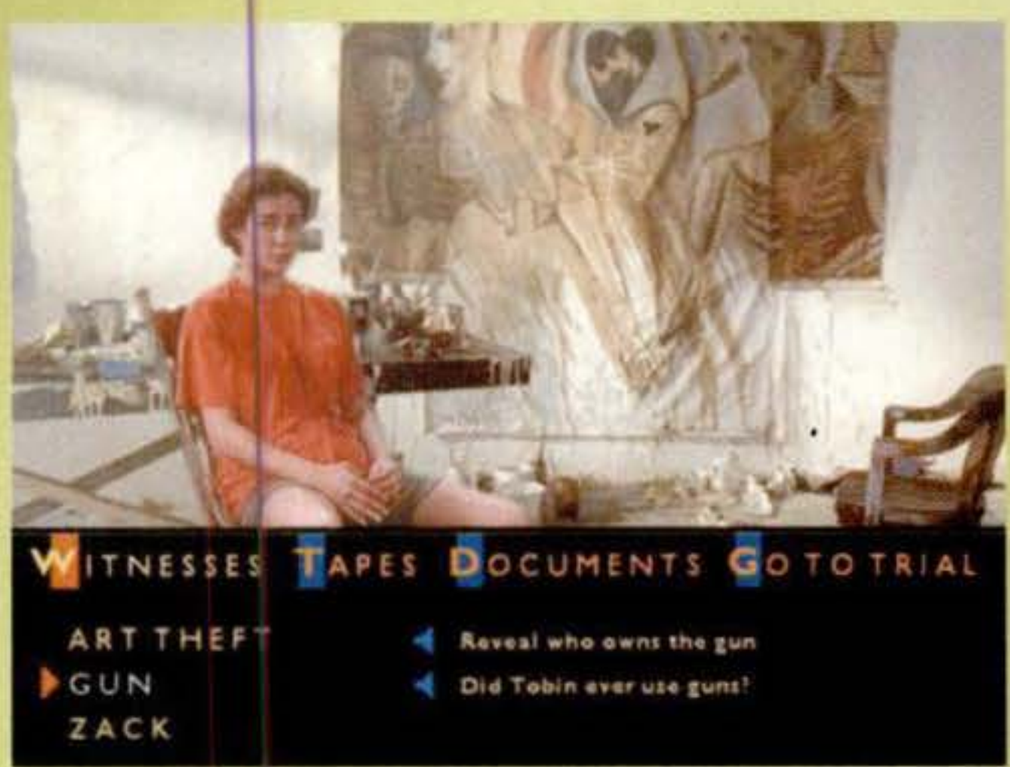
COMPAQ'S LINE of consumer PCs, the Presario 9500 series, peaks in this Presario 9564 133MHz Pentium model. Along with blazing speed, the 9500 has a comprehensive set of multimedia features: MPEG full-motion video, Spatializer 3D surround-sound, and wave-table synthesis (instrument-like) sound—all built into the main system board. The powerful supporting cast includes 16MB of memory, a one-gigabyte or larger hard drive, and a quad-speed CD-ROM drive. With monitor, it costs about $2,900.

Low-Cost High Tech

TAKING A decisive new direction, Honda's Civic represents the first high-volume-production car with continuously variable automatic transmission. Based on technology developed by Van Doorne of Holland, the fuel-efficient transmission runs at constant rpm, changing gear ratio to speed up or slow down. The transmission is available in Honda's basic Civic. With a variable-valve timing engine and sophisticated double-wishbone suspension, Honda demonstrates that finesse and high technology aren't restricted to the ranks of luxury cars. Base price: about $10,000.

Digital Detective

SOFTWARE IS beginning to imitate real life, and there's no better example of that than Broderbund's In the First Degree, on CD-ROM for Macintosh and Windows PCs. It blends video sequences with richly drawn background graphics to capture the real-life drama of tracking down and prosecuting a murder case. You get to interview suspects and witnesses, and decide how the court case should proceed. The program sells for about $50.

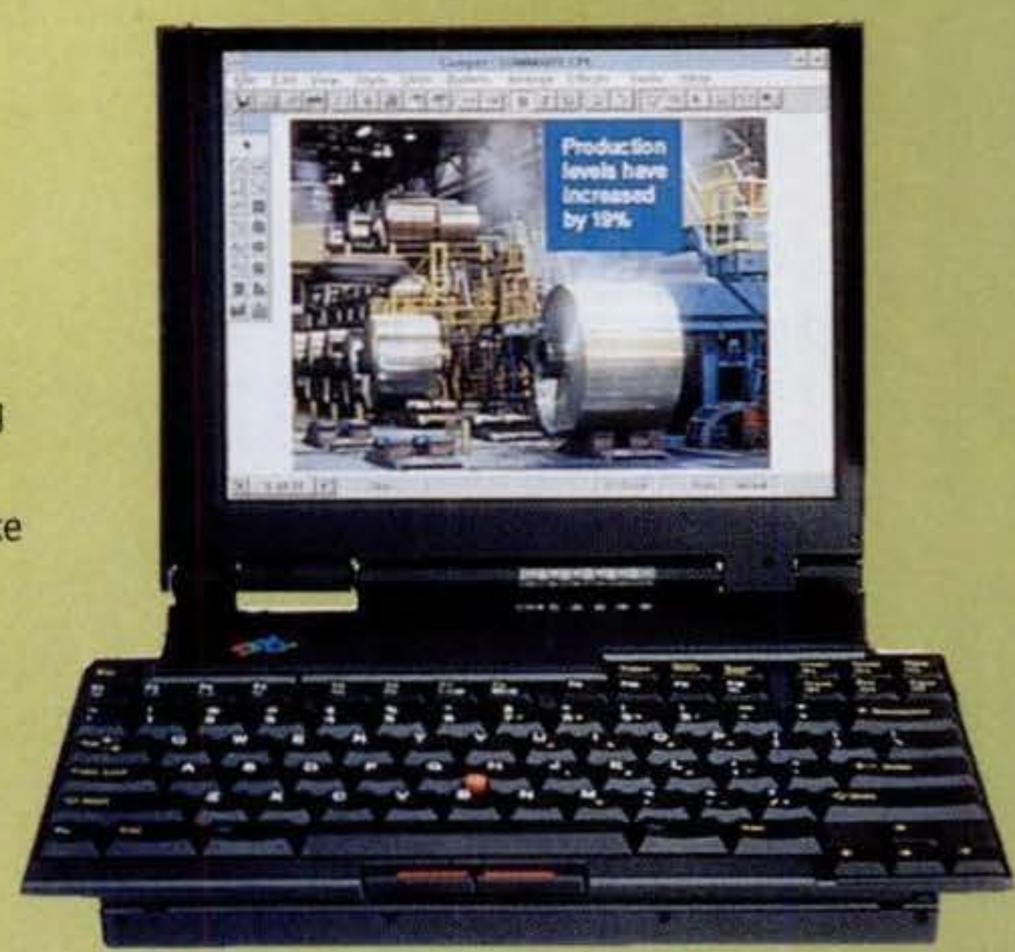


This Saw's a Cut Above

MEET YOUR NEXT toolbox necessity: the Black & Decker multi-purpose saw. The lightweight, cordless reciprocating saw adroitly handles around-the-house projects—cutting wood up to 2 inches thick, drywall, PVC pipe, even pruning branches. The tool uses two VersaPak batteries—3.6-volt cylindrical rechargeables that can also pop into several other Black & Decker tools. Price: about $40; two VersaPak batteries and recharger cost about $29.

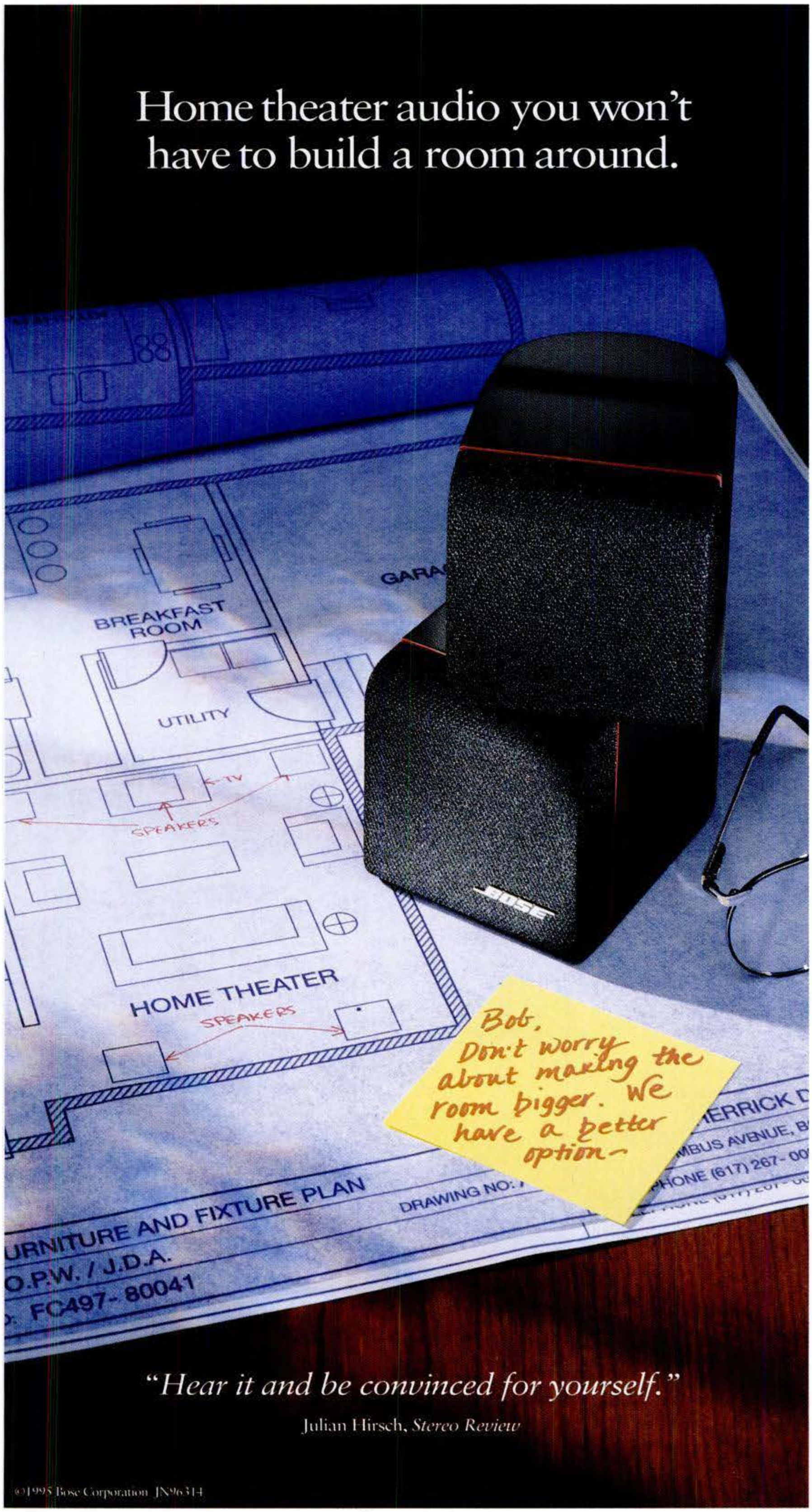
Butterfly to Go

EASILY THE most innovative portable computer in recent memory, IBM's ThinkPad 701C—nicknamed the Butterfly—has a blossoming keyboard—it springs up and out when you open the lid. That presents you with a full-size keyboard in a notebook-size package. Like other ThinkPads, the 701C also has a big, bright color LCD screen, built-in pointer (the red button in the keyboard), fax-and-data modem, speaker phone and voice-mail features, and many extras. Prices for the ThinkPads start at about $2,300.



For more information see RESOURCES on page 113.

Home theater audio you won't have to build a room around.



"Hear it and be convinced for yourself."

Julian Hirsch, *Stereo Review*

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Bose® Acoustimass® Home Theater Speakers. If you're trying to build a home theater system, there are more reasons than ever to consider Acoustimass speakers.

These little 6" speakers have already made a big impact on the way people think about sound. And now that you need up to five speakers to enjoy home theater, using these Virtually Invisible® speakers makes even more sense.

Instead of being overwhelmed by a room full of big, bulky speakers, you'll be overwhelmed by sound. Not only by its sheer power, but because it's so true-to-life. From explosive sound effects to the most intimate sigh, Acoustimass speakers reproduce surround sound with lifelike realism.

You get powerful home theater without having to rearrange your room to accommodate big speakers. And that leaves more space for all the people who'll want to join you after they hear a movie or big game on Acoustimass speakers.

To learn more about Acoustimass home theater speakers, call for Bose dealers near you. That is, if there's room for more exciting audio in your life.

1-800-444-BOSE Ext. 647

BOSE®
Better sound through research®

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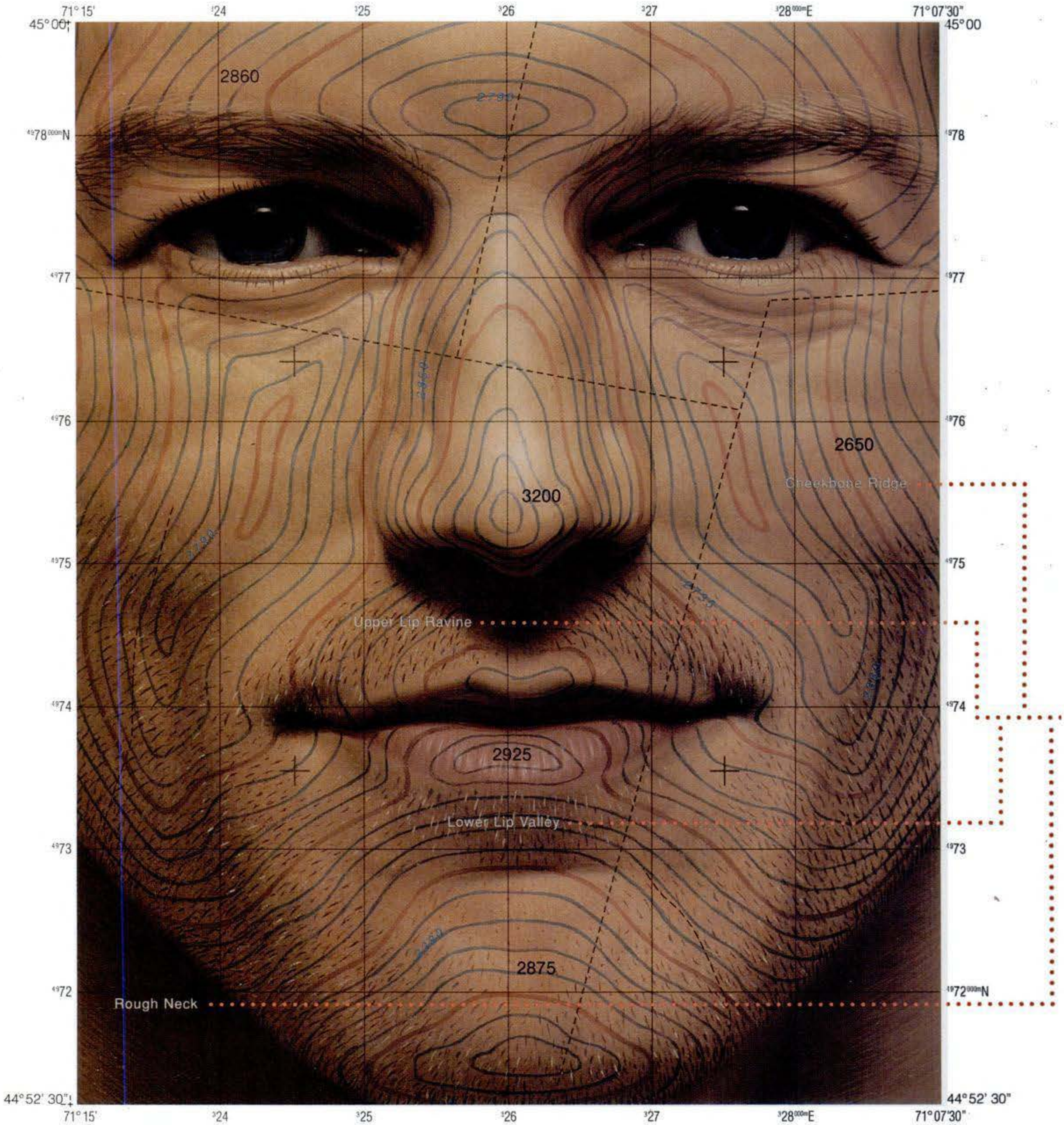

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BRAUN FLEX INTEGRAL.

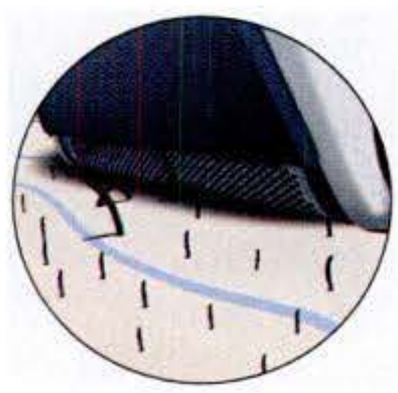
FINALLY, A SHAVER THAT SEES YOUR FACE FOR WHAT IT REALLY IS.

Hills and valleys, ridges and ravines. Difficult landscape where certain hairs grow taller, longer. The perfect terrain to introduce Braun Flex Integral.

Its revolutionary three-stage shaving system performs like no other shaver.

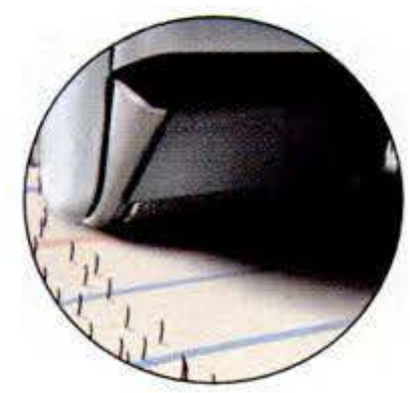
Even in problem areas, under the chin or along the neck where growth may be more vigorous, you'll get Braun's closest shave yet.

Traveling through difficult terrain requires the proper vehicle. The Braun Flex Integral.



Stage 1
One foil removes short hairs.

Stage 2
An integrated cutter – longer hairs.



Stage 3
The second foil completes the job.

BRAUN
The world's most recognized shave.

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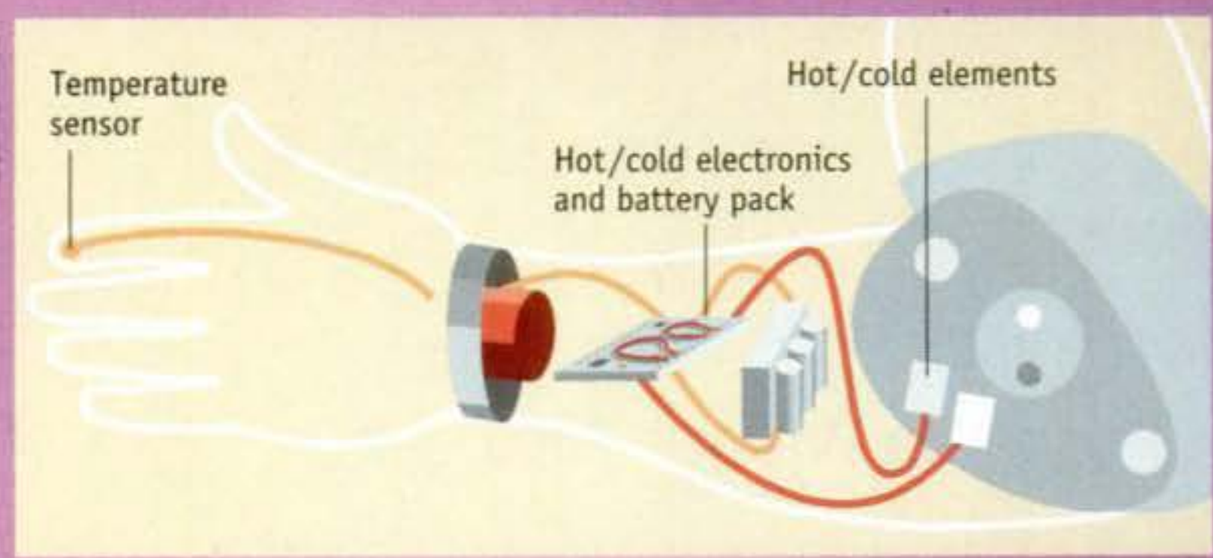


ALEX REARDON

Hot and Cold Hand

FOR THE FIRST TIME, prosthetic arms and legs can help users experience the sensations of hot and cold. Developed by NovaCare Sabolich Prosthetic and Research Center, the Hot and Cold Sensory System uses temperature sensors embedded in the prosthesis, which transmit signals via an electronic circuit to electrodes on the skin of the truncated limb. The skin then sends the signals to the brain. The system should add between $2,300 and $2,700 to the cost of a prosthesis.

BBQ That's a Gas

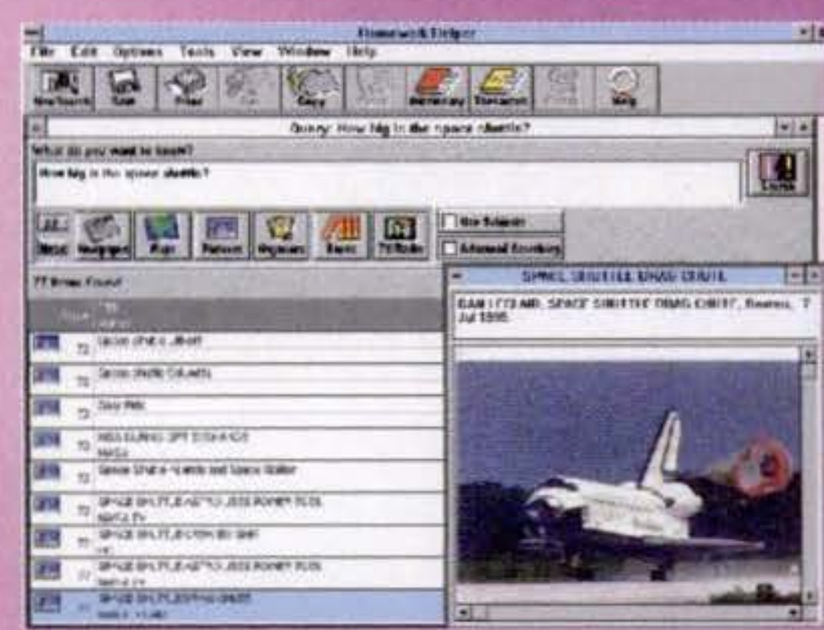
THE ANCIENT ritual of searing hunks of meat over an open flame now encounters technology: TouchLite, the first microprocessor-driven gas grill. Use the solar-charged battery-powered keypad to ignite the burners instantly, to set grilling temperatures, and to program the timer. A flame-detection system reignites the grill if the flame blows out. Next year, manufacturer Convenience Technologies will offer a remote control, so you can snap on the flame from your hammock. Prices start at about $500.

GRAND AWARD WINNER

AVIATION & SPACE

Together in Space

FOR THE FIRST time, a U.S. space shuttle docked with a Russian space station. Clamped together by a dozen latches, the *Atlantis* shuttle and the *Mir* station circled Earth for five days in mid-summer, giving astronauts and cosmonauts time to visit each others' spaceships and conduct joint biomedical experiments. The successful mission, which required delicate maneuvering, laid the groundwork for plans to assemble an international space station in 1997.



After-School Aide

HOMEWORK HELPER puts a harness on the information stampede for kids and teens. The service, available first on Prodigy and now via the Internet's World Wide Web, lets you type in plain-English questions (like, "Who were the Civil War generals?"). It then searches its online archives of books, magazines, newspapers, photos, and audio and video clips, and presents a ranked list of relevant materials. You can view, print, and download the items. Homework Helper, from Infonautics, costs about $10 a month.

For more information see RESOURCES on page 113.

Which fruit would you rather get this Christmas?

Fruitcake.

Fruit of the Loom® Extended Leg Brief.

Go for the Fruit of the Loom® Extended Leg Brief. The one with longer legs that won't shift, ride or bind. Or pick Ribbed Colors or Whites. They're all in the Gold Series – Fruit of the Loom's premium briefs. It's fruit you actually want.

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MFRS COUPON | OFFER EXPIRES 3/31/96

Save $1.00

on any package of Fruit of the Loom® Gold Series underwear, Casual Colors or Ribbed Whites underwear.

CONSUMER: Limit one coupon per purchase as specified on the face of this coupon. Any other use constitutes fraud. This coupon is not assignable or transferable.

RETAILER: Fruit of the Loom will reimburse you for the face value of this coupon plus 8¢ handling, provided you and the customer have complied with the terms of this offer. Upon request, you must show invoices proving purchase of sufficient stock to cover coupons presented. Limit one coupon per purchase of product indicated. Consumer must pay any sales tax involved. Any other use constitutes fraud. Good only in U.S.A., Puerto Rico and U.S. military installations. Cash value 1/100¢. Void where prohibited or restricted. May not be copied or mechanically reproduced. Send valid coupons to: Fruit of the Loom, Inc., P.O. Box 430766, El Paso, TX 88543-0766.

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Always in Season.

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Wobble Worries Ended

FOR ANYONE whose attempt at lobbing a Frisbee has gone awry, the Aerobie Superdisc is the solution: It's simply the most stable, easy-to-toss disc available. Designed by Alan Adler, creator of the record-distance-holding Aerobie Pro ring, the $9 Superdisc has a concave outer rim with two "spoilers" to create turbulent airflow. This keeps the center of lift at the center of the disc—so less wobble and banking.

Apex of Optical

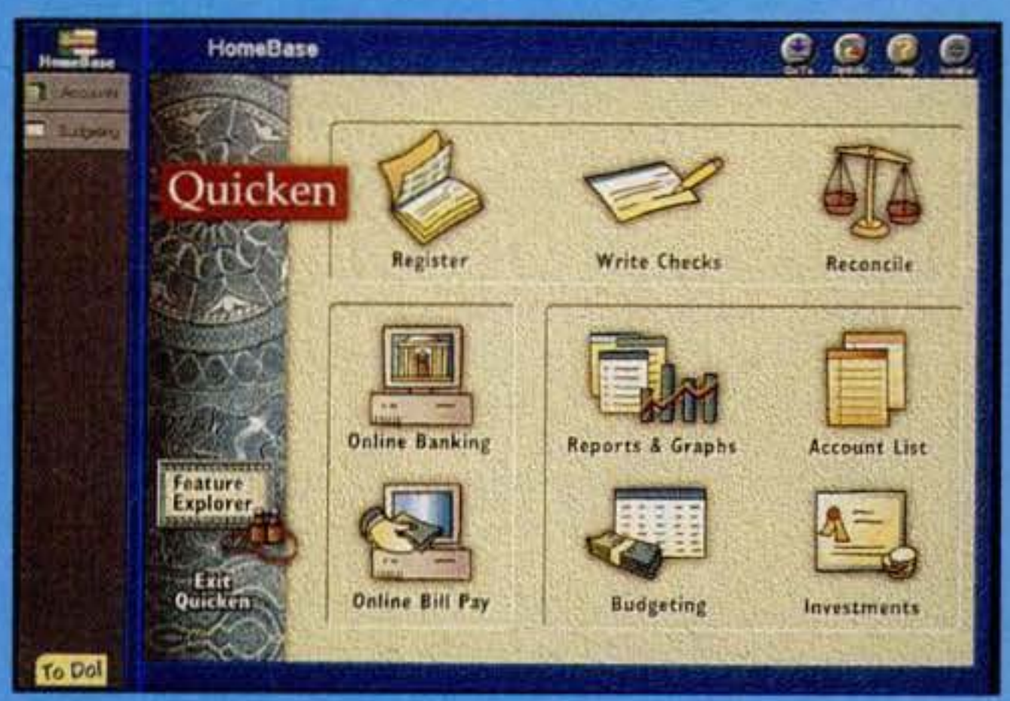
PINNACLE Micro's new Apex magnetic-optical drive is the breakthrough that could challenge the supremacy of conventional magnetic hard-disk drives in PCs. Apex writes on removable discs that hold 2.3 gigabytes of data on each side, or 4.3GB in all—about four times what most hard disks hold today. And you can keep putting in new discs for virtually unlimited data storage, while removing and locking up others for safekeeping. The Apex drive lists for $1,695.

Less Is More

YOU SEE TWO pairs of pint-size—literally—speakers and hear rich stereo. How? The Bose Lifestyle 20 has tiny drivers and neodymium magnets in cubes with ports that flair like jet engines to produce midrange and treble (illustration). A larger box on the floor houses a subwoofer and 200-watt amp. Center stage is a sleek silver six-CD magazine, the most compact we've seen in a home system. Price, including AM/FM tuner and a radio-frequency remote that works through walls: $2,300.

Practical Home Banking

INTUIT'S QUICKEN Deluxe 5 for Windows (and Deluxe 6 for Macintosh) meshes full-service online banking with all of the personal-finance features that Quicken is famous for. Nineteen of the largest banks and financial institutions in the United States—with more to follow—can work directly with this edition of Quicken to provide a full range of online banking capabilities. The program also includes a new electronic bill-paying service, and new ways to research stocks and mutual funds. Price: $50 to $60.



Good Deal

KIA OF KOREA gave its compact Sportage the shapeliest exterior in the sport-utility crowd. The Sportage is constructed atop a rugged frame; its wheelbase is long for a car this size, which aids lateral stability. Pleasing ride quality on-road or off, and an affordable price tag make this little truck an attractive newcomer. Two-wheel-drive model prices start at $13,500; base price for the four-wheel-drive Sportage is $14,500.

All in One Computer

APPLE'S LATEST take on the all-in-one computer concept is the most stylish and powerful to date. Integrating an entire computer into what looks like a sleek, tilting monitor, the Performa 5215CD is powered by a fast PowerPC chip and includes all the multimedia essentials: a quad-speed CD-ROM drive, built-in stereo speakers, digital sound, and a stunning 15-inch color display. It comes with 8MB of memory, a one-gigabyte hard drive, and a 14,400bps modem. The price is about $2,200.

GRAND AWARD WINNER

COMPUTERS & SOFTWARE

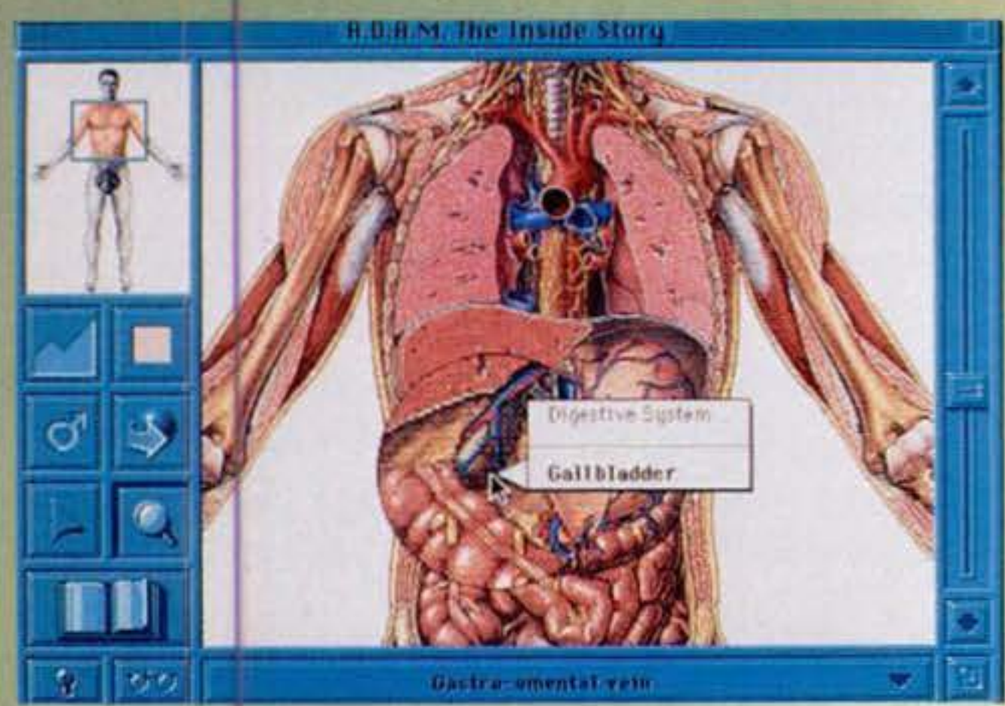
Windows on the Future

A COMPLETE overhaul of the software that runs most PCs, Windows 95 will help millions more people get started with computers, now and in the years ahead. It sports a cleaner and simpler interface—including the now-famous Start button—and a "plug-and-play" system that will make adding new components in the future a no-sweat proposition. Windows 95 also ushers in a new generation of faster, 32-bit software that takes far better advantage of recent advances in computer-chip technology. Price: about $85.

Homecoming in Yellowstone

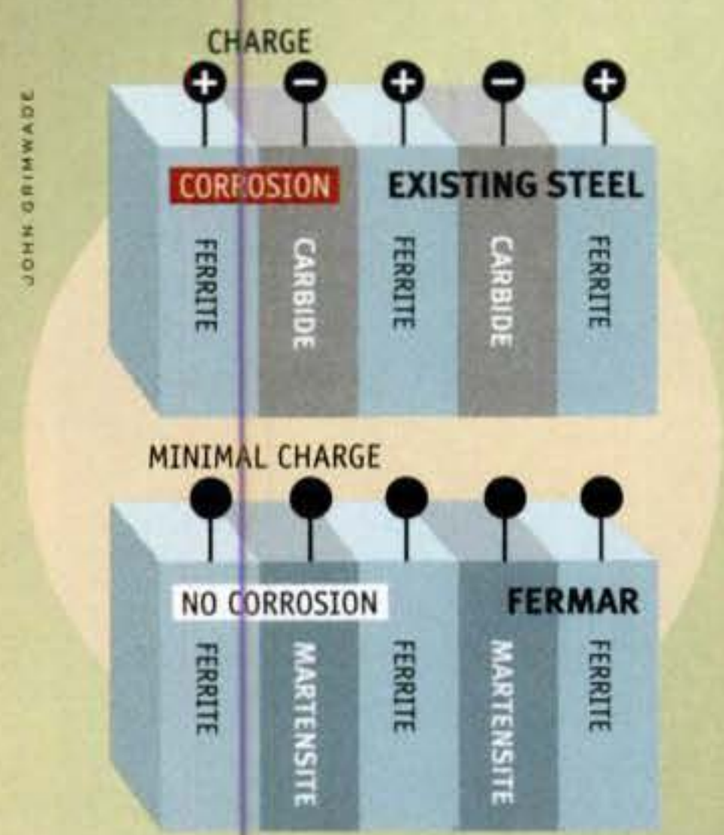
AFTER A 60-YEAR absence, wolves have returned to Yellowstone National Park. At the urging of ranchers, government hunters had exterminated the last remaining wolves from Yellowstone in the 1930s. But the endangered gray wolf is a predator that helps stabilize populations of elk and other wildlife. U.S. Fish and Wildlife Service biologists released 14 wolves, which had been captured in Canada, into the park. Until the reintroduction this year, the wolf was the only native species missing from the nation's oldest park.

For more information see RESOURCES on page 113.



The Body Electronic

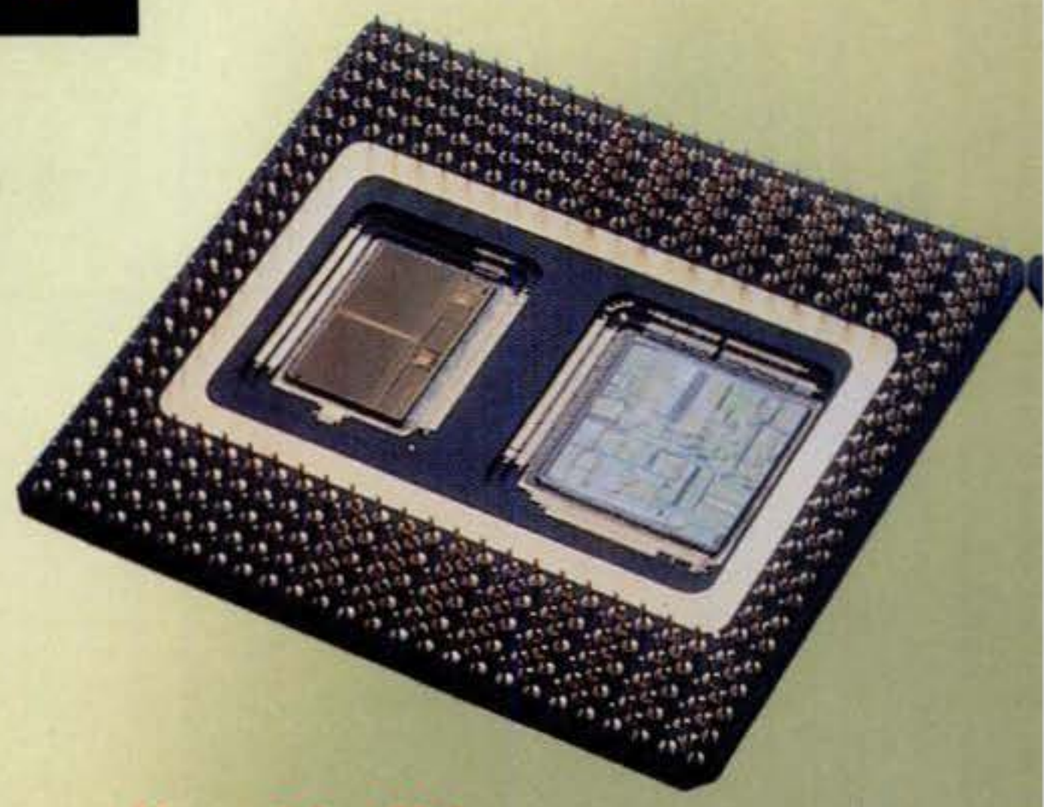
WHAT ARE YOU made of? Nothing answers that question quite like A.D.A.M. The Inside Story, from A.D.A.M. Software. Like other "bodyware" programs, A.D.A.M. makes learning about the human body fun, but it doesn't skimp on the particulars. Using animation, video, and vivid color diagrams, it lets you explore the body from skin to bones in graphic detail. The Windows or Mac CD-ROM costs about $40.



JOHN GRIMWADE

Rust-Resistant Steel

A NEW TYPE of steel called Fermar, invented at the University of California, Berkeley, could save billions of dollars now spent to repair corroded buildings and bridges made from steel-reinforced concrete. In the presence of salt and moisture, the two components of ordinary steel—ferrite and carbide—act like electrodes in a battery, turning some of the ferrite to rust. Fermar, however, is made by quenching hot steel in a bath—a process that replaces rust-promoting carbide with martensite.



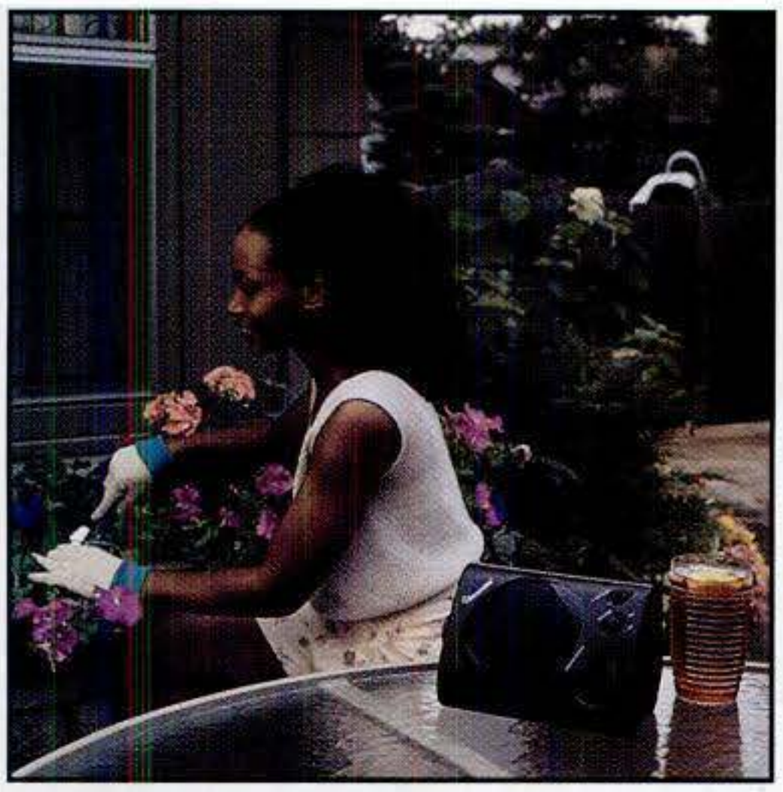
Next Big Chip

INTEL'S PENTIUM PRO microprocessor, the new big brother to the original Pentium, is spawning a generation of even faster, more versatile PCs. Pentium Pro uses "dynamic execution" techniques to respond to overlapping requests—rather than executing them in simple linear fashion—which can make it twice as fast as today's best Pentium chips. Pentium Pro is also optimized for 32-bit programs, such as those written for Windows 95, and a secondary memory chip is onboard for fetching instructions faster.

Carousel Bike

WITH TWO PEDALS that move together and a seat that lifts and lowers along with them, you RIse, SIt, and GO on the Risigo bike in a motion reminiscent of riding an amusement-park carousel. The motion requires half the energy of conventional pedaling, says maker System Engineering Ltd.—but more than that, it's just fun. The pedals also can be converted to the conventional one-up one-down bicycling style. Price: $370 to $470.

For more information see RESOURCES on page 113.



Decorate Your Home With Beautiful Sound. Wire Free.

With the Chase Technologies WS-5500 wire-free speaker system, it's easy to make beautiful music anywhere in your home, even the backyard. This breathtaking new technology provides spectacular sound reproduction without complicated, expensive wiring. Without power cords. Using batteries or standard outlets, these all-weather speakers are perfect for outdoors or indoors—anywhere you want to hear uncompromising sound quality.

Hassle-Free Installation, Crystal-Clear Sound.

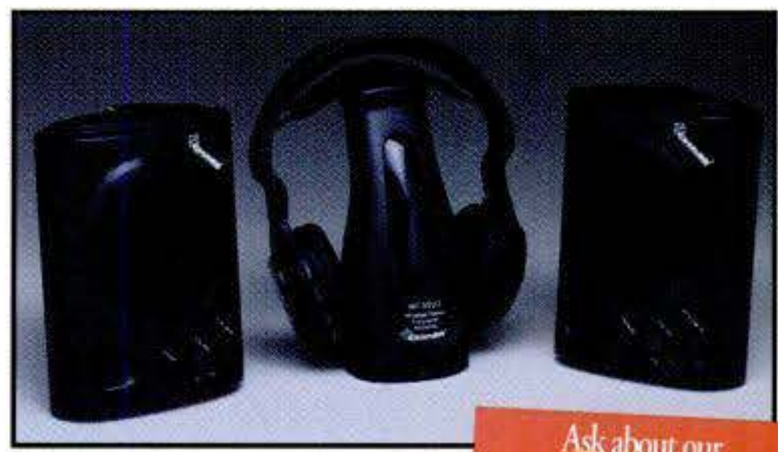
Simply plug your existing stereo, TV or VCR system into the Chase transmitter. The sound travels undisturbed through walls, ceilings, floors and even glass on a 900MHz radio frequency. Early wireless speakers used "line-of-sight" infrared technology or 49MHz telephone technology that caused all kinds of noise and drift problems. Our new system is the world's first stereo wireless speaker system to rival conventional hard-wired speakers in terms of clarity, detail and high-fidelity. And specially developed ALC (Automatic Level Control) circuitry prevents background noise and eliminates drift—a Chase exclusive. Special internal switches also let you assign right or left reception in a pair of speakers or select mono for a single-speaker room. It's the affordable solution to multi-room music.

Experience Wireless Sound For As Low As $179.

All you need to get started is the Chase transmitter and a speaker, or order the Chase WS-5500 Stereo System and receive the transmitter, 2 speakers and 3 AC adapters, plus easy-to-follow instructions for only $279. For flexibility, each piece is available separately, too. Add any number of Chase speakers in or around the house—placed up to 180 feet away. If you've hesitated to upgrade to surround-sound because of all the wiring involved, the fully self-contained Chase WS-5500 system is an ideal solution. Handy wall mounting brackets are also available to help you position these wireless wonders for maximum impact. Plus we even offer studio-quality wireless headphones for your private listening pleasure. And remember, you need only one transmitter to unleash the freedom and joy of wire-free listening.

Risk-Free, Factory-Direct 30-Day Audition.

We're so confident that you'll absolutely love these new speakers that we invite you to audition the Chase WS-5500 system in your home for 30 days. If for any reason you're not truly delighted with your purchase, simply return it to us for a full refund. Decorate your home with beautiful sound, wirelessly.



Ask about our 0% Financing 30-60-90 Day Pay Plan for the WS-5500
3 easy payments of $97 per month are automatically billed to your credit card.
(includes shipping and handling)

WS-5500 System $279. $12 S&H
Available in black or white.

MS-510 Speaker $99 each. $8 S&H
Available in black or white.

WH-550 Wireless Headphone $99 each. $5 S&H

WT-5500 Transmitter $79 each. $5 S&H

Also available: WMB-5500 Speaker Wall Mount Bracket (not shown) $50 pair. $8 S&H

CA residents add 7.75% sales tax. Please allow 21 days for delivery.

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Finesse Costs Less

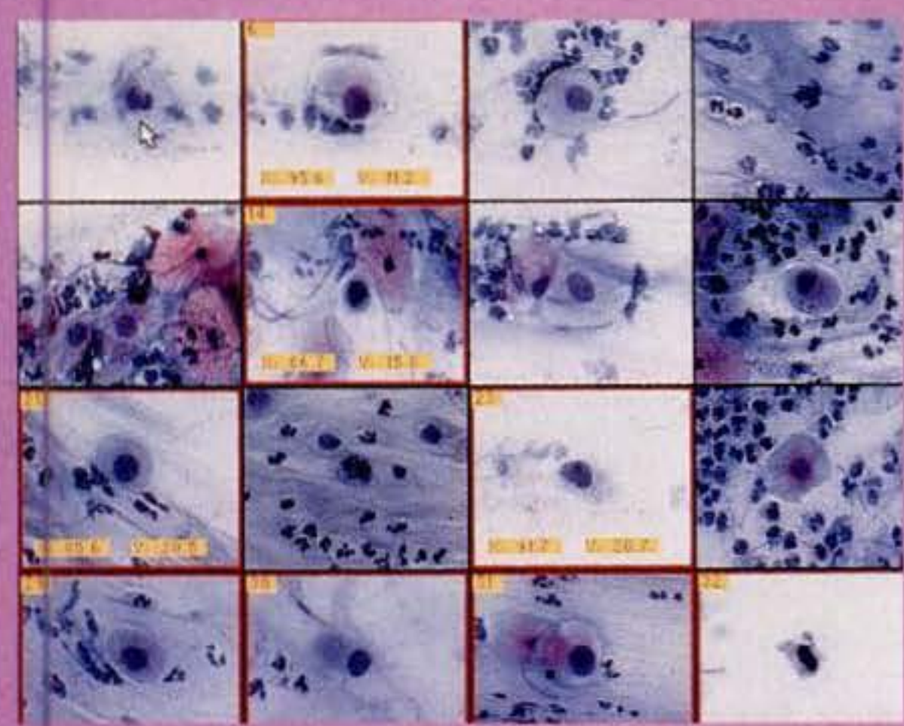
TECHNOLOGIES borrowed from the aircraft industry make this elegant new wind-turbine design lighter and cheaper than its predecessors. The Northwind 250, a 250-kilowatt experimental machine developed by New World Power Technology Co., uses airplane-style ailerons to control the pitch of the turbine blades while they are spinning. The ailerons, together with a two-blade rotor that is constructed as a single piece, eliminate the need for having heavy flanges and motors at the roots of the blades.

Rainbow Copier

A COLOR COPIER of your very own? Hewlett-Packard's CopyJet brings that within reach of home offices and small businesses. The CopyJet is a combination color ink-jet printer and color copier. Its flatbed copy surface (under the lid at top) lets you scan loose or bound pages, and it can make copies in full color—on plain paper, for about 7 cents per page. Price: about $2,500. A network version, the CopyJet M (with PostScript support for use with Macintoshes), costs about $3,200.

The Color Purple

ZURA SPORTS has replaced the ubiquitous tombstone-shaped kick board with a low-buoyancy boomerang called the Speedray. The elegant new design of this classic swimming accessory allows for a relaxed, "flattened" posture that is more comfortable for the back, less tiring, and more accessible for smaller swimmers. The price for the Speedray, which comes only in purple, is about $20.



Computer Check

READING PAP smears (photo) in the laboratory is difficult—a matter of finding several abnormal cancerous and precancerous cells among thousands of healthy ones taken from the cervix. Up to one-third of the tests may show false negatives. Now computer technology developed for the military could double-check the 50 million pap-smear tests performed every year. While the technology could nearly double pap-smear costs, it will improve the reliability of results. The FDA has approved NeoPath's system and is considering another's.

For more information see RESOURCES on page 113.

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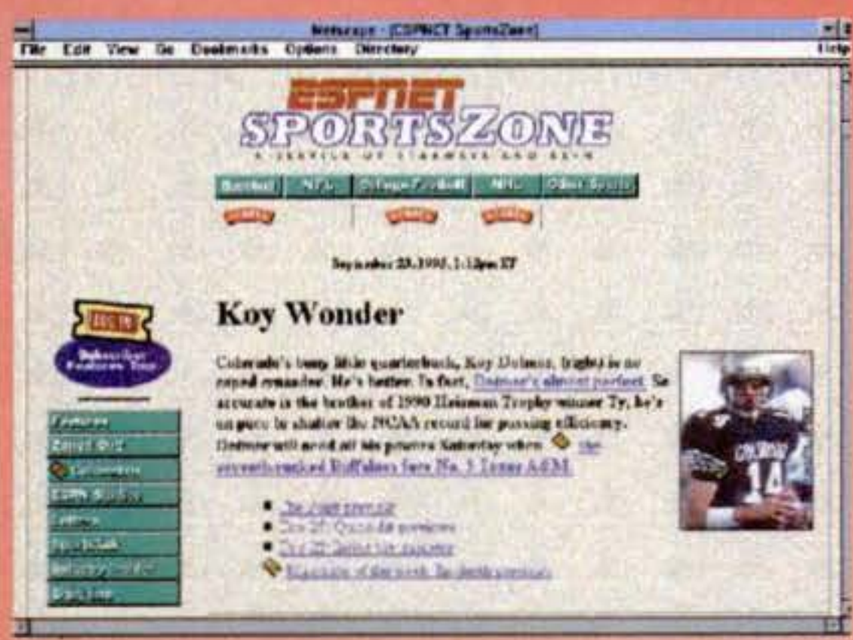
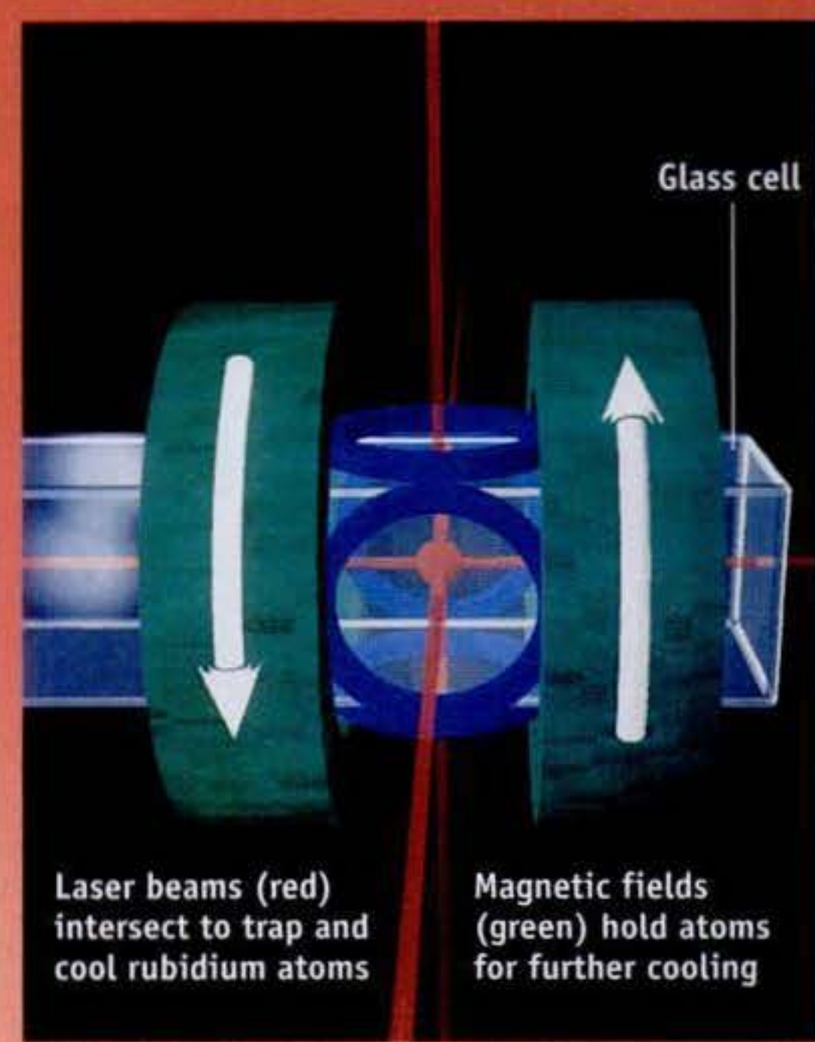
Ultimate Sports

ESPN SportsZone is the online sports fan's best friend—and a model for what makes a World Wide Web site compelling. It lets you keep a real-time eye on the scores of all of the games being played that day, plus offers an array of interesting features, profiles, interviews, and commentaries on the world of sports. Its bright, organized screens are loaded with information that's delivered well before the morning newspaper. A subscription costs $4.95 per month.



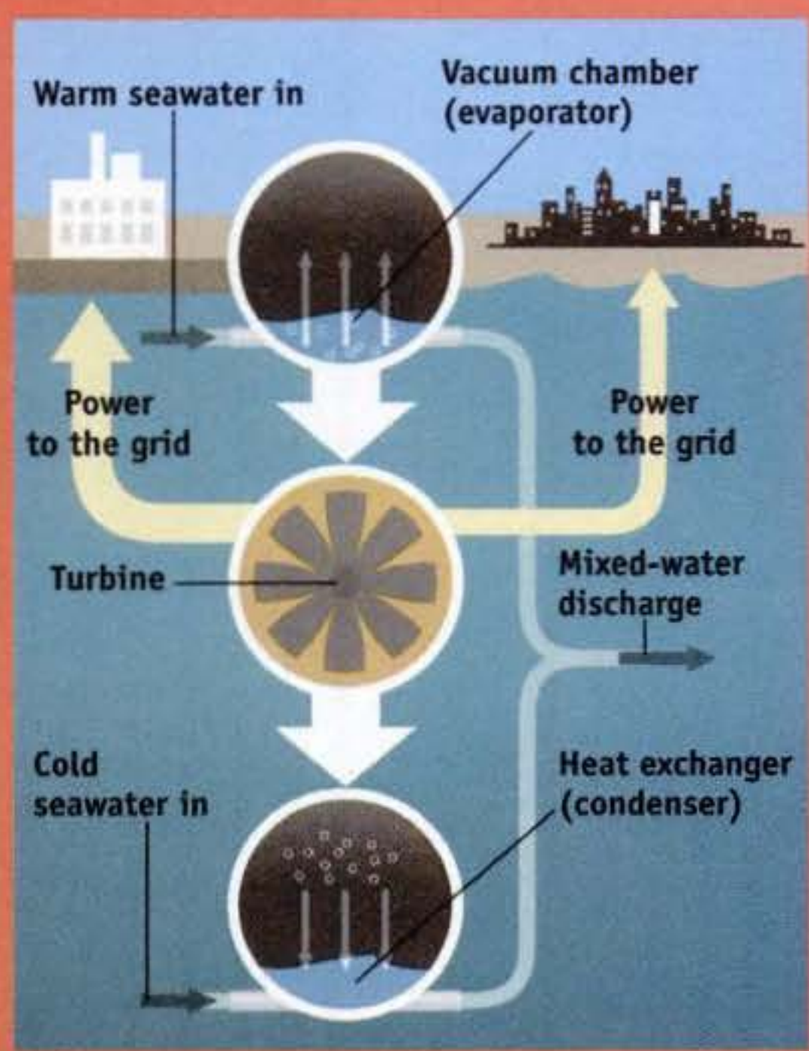


New State of Matter

ALBERT EINSTEIN and the Indian mathematician Satyendra Nath Bose predicted decades ago that a gaseous cloud of atoms, if cooled to an extremely low temperature, would behave like a single giant atom. This year, scientists at the Joint Institute for Laboratory Astrophysics finally created such a "superatom," called a Bose-Einstein condensate, by cooling rubidium atoms in an atom trap (illustration) to less than 170 billionths of a degree Celsius above absolute zero.

Power from the Seas

OCEAN THERMAL Energy Conversion (OTEC) is a clean answer to the search for energy. It generates power using the natural temperature differences in tropical surface and deep-ocean water. The largest prototype plant, in Hawaii, holds the record for the technology: 255 kilowatts, with 104 net for the local grid. While OTEC is not a new idea—it was first conceived in the 1800s—the Hawaii plant shows it's possible to consistently generate more energy than the process requires to run.



K. DANIEL CLARK

Truck for the Future

FORD'S F-SERIES full-size pickups are lighter, stronger, and roomier than their predecessors. Yet they maintain full load capacity and towing ratings—while actually lowering emissions and improving mileage (by 2 to 4 mpg). The ground-up redesign includes a family of new overhead-cam engines and a redesigned front suspension and steering package. A rear door is standard on the supercab model, one of the many ingenious features that makes this a pickup for the next decade. Prices start at about $14,000. ◆

For more information see RESOURCES on page 113.

It's time *your* *telephone* and *PC* *started* talking the *same* language.

Your phone and computer will click like never before.

Let your computers work the phones.

Call for a free game disk. Discover the power of Passage to the Impossibly Rich.

Next time you're at your desk and the phone rings, imagine having the name of the client who's calling you pop up on your PC. Along with his current files. And imagine never having to keep track of incoming and outgoing calls again. Because it's done for you. Automatically.

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WELCOME TO THE EDGE

The best thing about stun defense is just that. They only stun. That's why police accross the country call them a great alternative to guns. No sorry mistakes, no child tragedies.

Now you can even own *tri-level* defense in one pocket-sized concealable package. New Triad's *pulse-volt coils* pack a wallop tougher than stun-guns twice as large. Right through clothing! Yet effects wear off in just 2-3 minutes – plenty of time to get help or get away. Plus, a built-in alarm sounds on your switch command, or if the wrist-pin is pulled. A micro-halogen light disconcerts assailants, giving you time to act. (Also an excellent emergency light.) Keep the Triad on your keys, or give one to someone you care about. It's shockingly affordable, and causes absolutely no lasting effects.

TRIAD
Personal Defense System

- **Triad™ Personal Defense System #300ZX $39.95**
- **Set of two Triads #300ZX-2 $34.95 each. Save $10.00**

Screw anywhere, with hand-held power and your choice of 25 attachments. Or loosen your nuts with the free 6-piece socket set. And re-charge in under an hour!*

Of all the power tools you'll ever buy, you'll use this one the most. At home, on the job, and on the road. Unlike cheap imitations, the new cordless Drill-Driver is a dynamo. Reversible, variable speed motor is a full 12 volts – not 7.2. This means drills bite cleanly, screws penetrate the toughest woods, and rusted bolts snap free. You save time, calluses, and headaches. Tiresome tasks become a breeze. Torque even adjusts to four settings. And the trigger locks-on for prolonged action. Rugged ABS case holds:

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- 3 SLOT BITS
- 3 HEX BITS
- 3 PHILLIPS BITS
- EXTENSION BAR
- 3 ROBERTSON BITS
- 4" MAGNET
- SIZE ADAPTOR
- 6 SOCKETS

POWER-TO-GO™

Now try the complete Drill-Driver set risk-free at home with the power of our iron-clad guarantee. Right away you'll ask yourself why you waited so long.

**Tool is a genuine task kicker, priced way low. Lurid headline is included absolutely free for your enjoyment.*

- **Cordless Power-To-Go™ 12V Drill-Driver Set #CL-1800 $79.95**

Discover what it's like to see in the dark.

Push the trigger. The T3C-2 Scope powers up. Suddenly, in green-hued clarity, night is like day, magnified 3.2 times! Designed for USSR Special Forces, powerful T3C-2 Night Vision Scope lets you see clearly in just starlight. Now switch on the Infrared Illuminator – and see in pitch black *total darkness.*

Optics focus smoothly from 3' to infinity. Complete with carrying case. Requires 6 AA batteries. Tripod mountable.

Sale!
even includes Illuminator!

Nature study, law enforcement, boating, camping, or just viewing your own neighborhood, this once-secret Cold War technology is now yours. Lifetime warranty.

- **T3C-2 Night Vision Scope, with Illuminator #T3C-2 ~~$479.00~~ Now $299.00!**

Sorry, Mr. Jones is not in. This is Lucille, his secretary, may I help you?

New micro-size voice disguiser even works with pay phones!

Fool your friends, confuse your enemies, be your own secretary, make anonymous calls for business or security reasons, or protect women and children home alone.

Unlike sophisticated desk-top voice-changers, the Micro-Disguiser has no modular hook-ups! Slip it from your pocket and place it over any pay phone's mouth-piece! Miniature electronics alter your voice in a choice of eight different levels. Extreme settings sound hilarious, and mid-ranges will even fool your own mother.

- **Pocket Micro Voice-Disguiser #VC-168 $39.95**

Get one for a woman friend, too, and let harrassing callers think a man is at home.

Reduce stress and enjoy your trips more. New handheld Tripmate™ replaces 200lbs of maps with instant highway data – at your fingertips!

Want to know where the next motel or gas station is? Just flip open the Tripmate, key in the highway you're on and the answer is displayed instantly! With distance, driving time, exit, and directions! Need a hotel? Campground? Tripmate's electronic brain contains over 40,000 highway services – including 24 hour locations. Malls, hotels, rest areas, *and* restaurants. Also gives you distance and time to towns and other freeways. For emergencies, hospital locations are instantly provided, as well as 800 #'s for state patrols. Measures just 5 1/2" x 2 1/2" x 1/2" – slips into pocket or car visor. With batteries, two-year warranty, and an offer to save 50% at over 2,000 U.S. motels. Best of all, deluxe flip-open version is updateable every year, ensuring that your future trips are just as smooth, too.

"Absolutely amazing"
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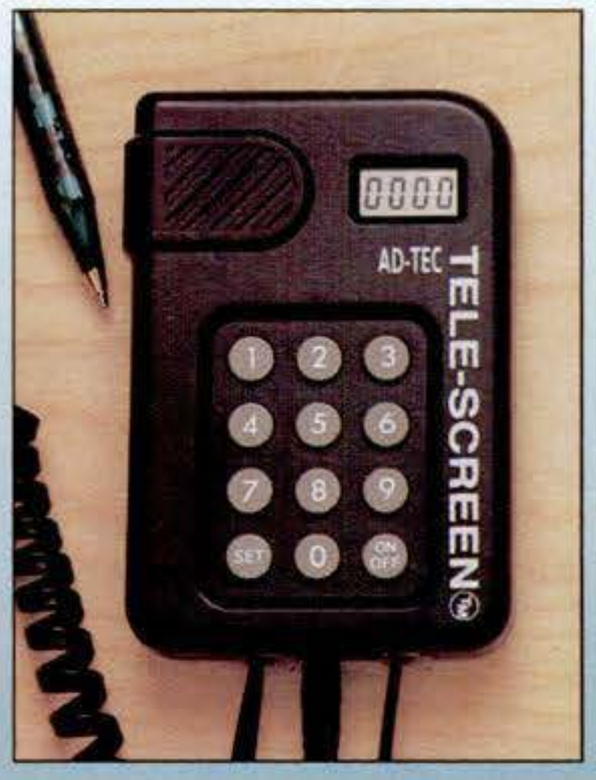
- **Tripmate™ Traveler #TM-2000 $59.95**



Take back control of your telephone.

Tele-Screen™ Phone Protector eliminates unwanted calls. Harassing calls, sales calls, any call you wish. Incoming calls are greeted by a voice prompt: *"Thank you for calling. Please enter the four-digit pass-code."* Your phone rings only if the caller enters the correct code. Voice prompt repeats and if no code is entered, the caller is automatically disconnected! Use the keypad to change the code, or de-activate the unit. It's like having an unlisted phone number when *you* want it unlisted. Like during study, meal-time, romantic evenings, or when you only want calls from those you gave your password to. Also secures fax and modem lines!

- **Tele-Screen™ #TS-300 $44.95**

Installs easier than an answering machine, with its own AC power pack. Rings once to let you know it's working. Un-Telescreened extensions will regular ring.

TACTICAL ONE-HANDER™

Third Generation

And now even better. Roll your thumb and expose a drop-point blade of 440A stainless – hollow ground and scalpel sharp. An adjustable double-disc pivot screw allows for complete blade speed control. Compress the strategic locking device – just as quickly your blade is closed.

Designed for discreet carry, the lean profile of The Edge Tactical One-Hander is *less than 1/4"*. Each is machined and milled from a solid bar of pure chromium spring steel. When the unknowns of work, sport, or emergency demand fast one-handed performance, there is no tougher knife.

Call us and field-test one yourself – with the full protection of a lifetime warranty. From the highway to the high country, this is a powerful and ingenious knife – unlike any other you will own.

SPECIFICATIONS

EDGE TACTICAL ONE-HANDER #7004

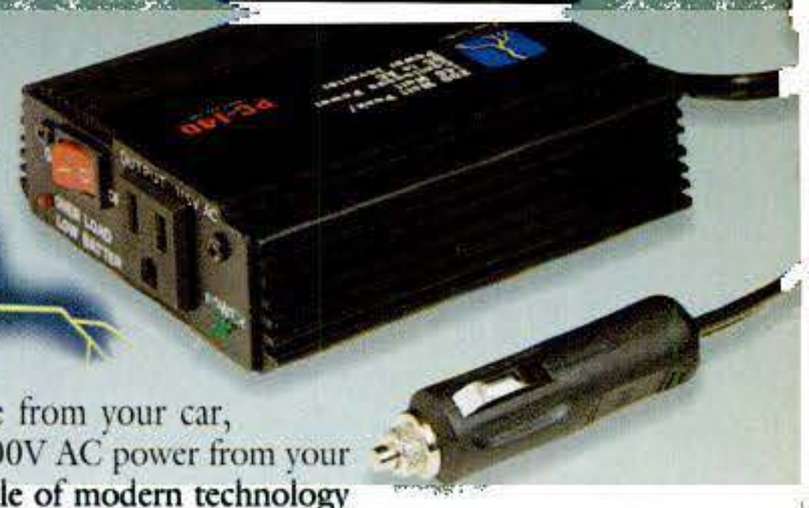
Length Open: 7"/18cm	Handle: 420 Cr Spring Steel
Length Closed: 4"/10cm	Blade: 440A/R57-59
Weight: 2.4oz/67.2g	Blade Length: 3"/7.5cm

#7004

- **Edge Tactical One-Hander #7004 $39.95**
- **Edge Tactical Gator-Edge #7005 $39.95**

#7005

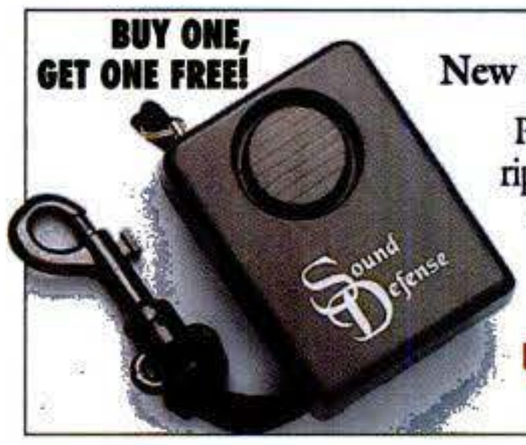
DC to AC POWER INVERTOR



Transform your dashboard lighter into a traveling power-plant.

Run any tool or appliance from your car, truck, boat, or camper. Full 100V AC power from your vehicle's 12V battery. A miracle of modern technology – in a 5" x 4" package. It works by duplicating the complex "sine-wave" of AC power. Now you can recharge power tools on the job, watch TV while camping, access your laptop PC, or just plug in a lamp and read under the stars. Completely safe for both your car and your appliances. Even when the car is off. Automatic alarms won't let you drain the vehicle's battery, or overload your appliances. Now enjoy all the convenience of real power-to-go.

- **PC140 Power Invertor,** single receptacle, delivers 140 watts continuous power, 200 watts peak power. **#PC-140 $49.95**
- **PC300 Power Invertor,** dual receptacle, delivers 300 watts continuous power, 500 watts peak power. **#PC-300 $89.95**



New sonic hand-grenade. Thug rejection at half-price!

Press the trigger or pull the trick lanyard cord. Either one rips a blaring 110db alarm – waking the neighborhood and sending assailants scampering! Built-in clip keeps it where you need it – on belt, pack, or car visor. Best of all, it's on sale now, two for the price of one!

- **The Thug-Chaser Personal Alarm #PA623 $18.95**

Wear the watch that kept Russian spies on time.

Issued to first year KGB recruits, the 17 jewel KGB watch was a badge of honor. Emblazoned on its teal-green face is the dramatic red seal of the infamous intelligence network. Below is "KGB" in cyrillic letters. Made in the original factory outside Moscow, with black leather band, moveable nickel-silver bezel, and accurate to seconds per month. Now own the last of a genuine cold-war relic, and get to your next party meeting on time, too!

- **Original Soviet KGB Watch #KGB-W $59.95**

Own the last of Russia's restricted issue spy glasses.

Designed for the Soviet operatives. All metal micro-binoculars fold away to disappear into palm or shirt pocket. Yet super advanced coatings and huge 2.5 x 17.5 power yields crystal clarity, even in low-light conditions. Hunting, sports events, concerts, nature study, or surveillance. Now get the powerful 1 1/2" long cold-war edge.

- **Dual Focus KGB Micro-Binoculars #R-215 $29.95**

Can also be used reversed as low power microscope. Includes Russian documentation. Hurry, comrade, supplies limited.

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Free!

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They are visionaries. Or fools, depending on who you ask. They spend years assembling million-channel radio receivers. They suffer the slings and arrows of irate senators and UFO fanatics. They bear the lash of NASA program cuts. Yet they soldier on, sitting long hours at giant radio telescopes in the middle of nowhere, waiting for cosmic e-mail. This handful of astronomers and engineers, the stalwarts of the search for extraterrestrial intelligence (SETI), may just be on the verge of history's most momentous discovery. Then again, they may not.

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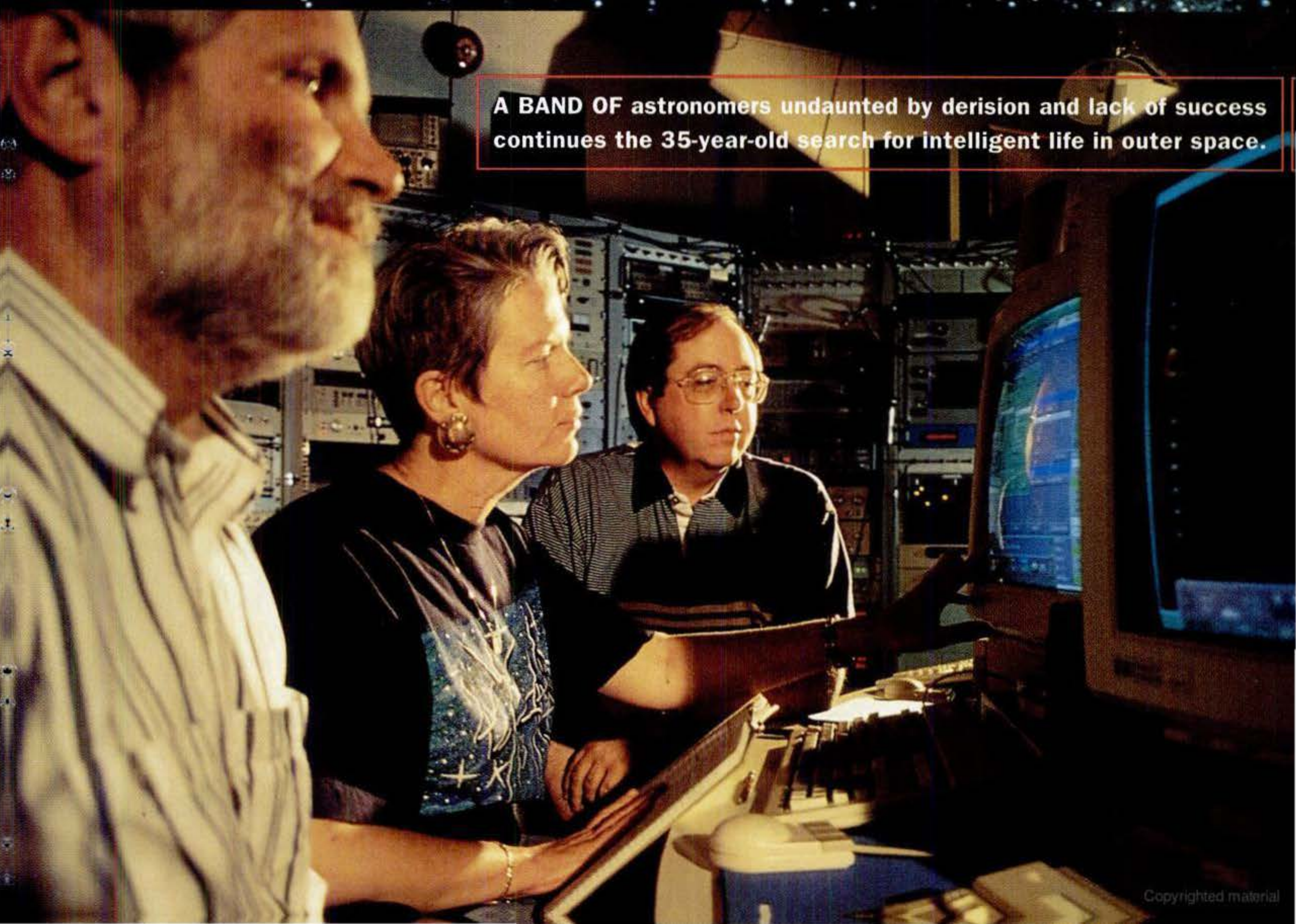
The Seekers

BY ANDREW CHAIKIN



A BAND OF astronomers undaunted by derision and lack of success continues the 35-year-old search for intelligent life in outer space.

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"This is the maternity ward," says Paul Horowitz, ushering me into his workshop in the basement of Harvard's Lyman Laboratory of Physics. Inside, amid tables covered with exotic electronic components, stands a man-size rack of circuit boards comprising Horowitz's newest baby: a radio receiver capable of monitoring 240 million separate frequencies at once. "It's like having 240 million radios sitting on your desk," he explains.

At 52, he still has a slightly boyish sense of wonder. Listening to him—he often speaks so quickly that it can be hard to keep up—it's easy to imagine the 7-year-old in suburban New Jersey who was, for a time, the world's youngest amateur radio operator. He thrilled to the sound of voices from halfway around the world, but his greatest joy, he says, was that "you could build things out of tubes, transformers, and other junk, that would let you talk to people."

Today, Horowitz and a couple of graduate students are building the cutting-edge electronics that may let humans hear the sound of civilizations outside our solar system. They've already put more than three years of effort into the sky-searching project they call BETA (Billion-Channel Extraterrestrial Assay), which is a year behind schedule. But Horowitz doesn't seem impatient; in this business, you can't afford to be.

THIS YEAR MARKS the 35th anniversary of the first SETI experiment, Project Ozma. In 1960, Cornell astronomer Frank Drake trained a radio telescope equipped with a single-channel receiver on two nearby stars. The reasoning, as set down in Drake's now-famous equation, was this: Of the estimated 200 billion stars in our galaxy, some fraction must be orbited by planets with intelligent life. If there are interstellar conversations, said Drake, Earth ought to be able to listen in. Despite its simplicity, Project Ozma (named after author L. Frank Baum's princess of Oz) laid the groundwork for more than 60 searches that have tried, with ever-greater sophistication, to prove Drake right. It doesn't matter to Horowitz that none of these efforts, including two of his own, have succeeded. Like everyone in SETI, he understands the difficulty of the quest.

Most of the searches, like Ozma, have focused on the so-called water hole, the only window in the electromagnetic spectrum (located near the wavelength associated with radio emissions from interstellar neutral hydrogen) that is nearly free of background noise. At these frequencies, radio is an amazingly efficient means of communications; one astronomer has estimated that an interstellar telegram between two civilizations 1,000 light years apart would cost a dollar per word. When Horowitz first heard Drake's carefully reasoned approach, as a Harvard graduate student in 1968, he realized that the big question, Are We Alone?—once the province of theologians—had moved into the domain of science. To search for an answer, all that was needed was a radio telescope, ingenuity, and time.

The problem, of course, is knowing where to point the telescope, and what frequency to listen in on. Imagine tuning in to every FM station in the world, hoping to catch the one playing "When I'm Calling You." As Drake himself says, "There are so many stars, so many frequencies, and so few dollars. We're always struggling to get the biggest bang for the buck." One advantage of Horowitz's BETA, for example, is that it is cheap by scientific standards, about $200,000 in all. To fund his searches, Horowitz has relied on private backers, including Carl Sagan's Planetary Society, and even a $100,000 donation from a special fan of SETI: filmmaker Steven Spielberg, creator of *Close Encounters* and *ET*. That's because most astronomers, while agreeing that SETI is probably worthwhile, don't believe it merits diverting precious research dollars from other endeavors.

Then there's the issue of how to search. Radio astronomers have tried two approaches, some using giant antennas to zero in on one star at a time, others using lower-powered dishes to sweep the sky in hopes of

A Formula for Intelligent Life

WHEN FRANK DRAKE launched Project Ozma in 1960 he sought a way to calculate the probability of finding other intelligent races. Here is his equation:

$$N = R^* F_p N_p F_l F_i F_c L$$

Though somewhat formidable looking, this is simply the number (N) of technological civilizations in our galaxy, as the product of a string of possibilities: R^* = the average rate in stars per year of star formation in the galaxy. F_p = the fraction of stars having planets. N_p = the number of suitable planets per planetary system. F_l = the fraction of planets on which life starts. F_i = the fraction of life that evolves to intelligence. F_c = the fraction of intelligent species to develop the means of communication. L = the longevity (in years) of the technological phase of such a society. Drake and other early extraterrestial-life enthusiasts, including Carl Sagan, arrived at a value for N between 100,000 and one million—still only about one technological civilization per million stars in the Milky Way, which astronomers reckon contains approximately some 200 billion stars.
—*Arthur Fisher*

Frank Drake

SETH SHOSTAK

STEVE LEWIS

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SETI EXPLORER Paul Horowitz and a few grad students built a multimillion-channel radio receiver for Project Beta at Harvard's Lyman Observatory.

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A 20-YEAR VETERAN of SETI wars, Jill Tarter searches for signals from space at the Parkes radio observatory in the Australian outback.

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getting lucky. The signal would have to be strong enough to be picked up easily, Horowitz says, and it would have to cover a very narrow range of frequencies to be distinct from natural radio noise. Such a signal, he speculates, would be a kind of acquisition beacon and could contain instructions on how to tune in to the actual message.

What might the message be like? If the ETs are far more advanced than we—which seems likely, given our technological youth—"a lot of what they're talking about is going to be quite incomprehensible," says Horowitz. But mixed in with this, he says, might be a more rudimentary, oft-repeated message, "a language lesson based on simple concepts of science." Given the enormous distances involved—a signal from even a relatively nearby star could take decades to reach Earth—a conversation would have to take place over generations. "Don't think dialogue," says Horowitz; "think monologue." Horowitz's thoughts, however, don't focus on the message, or on the fame he would receive if he found it, but on the search itself. "It's fun to talk about; it's fun to think about. It's not on my mind very much when I'm soldering joints."

ONE OF THE BIGGEST MYTHS about SETI is that whoever discovers the message would want to keep it secret—or that they would be able to. Horowitz refutes this by pointing out that the first step after discovery is confirmation by another team of radio astronomers. "You immediately call up Arecibo or Bonn or somebody," he says, "and have them look. You can't keep a secret like that. So now you've got a national radio observatory with 100 astronomers and staffers and their spouses, and their kids, and their dogs, who all know about the greatest discovery in the history of mankind. What are your chances of keeping the lid on that one?"

But so far, instead of making a world-shaking discovery, SETI has achieved only near misses. The most famous "close call" took place at Ohio State University, where SETI's longest-running project has been underway for the last 22 years. In 1977, observers there detected a signal so clearly artificial that one of them wrote "Wow!" next to the data printout. The transmission lasted only a minute and was never picked up again, despite hundreds of hours of listening by astronomers.

OSU astronomer Bob Dixon says the "Wow" event, as it has become known, "had all the characteristics of an intelligent signal, so we're convinced it was of intelligent origin. But we don't know if it was our own intelligence or some other intelligence." Maybe, Dixon speculates, it was "a secret military satellite cruising around in the solar system.... We'll never know the answer to this."

During the last 35 years, hundreds of other unexplained but less convincing signals have turned up, all of which have eluded confirmation. As Seth Shostak of California's SETI Institute explains, "When you do any kind of astronomical research, you go to the telescope, and unless you get rained out every night or you have an equipment malfunction, you come back with data." With SETI, he says, "Everyone who's done this has come back with no positive result."

To Paul Horowitz, this is the paradox that sets SETI apart from all other scientific endeavors. "What is it?" Horowitz asks. "It's a search, but it's not really science. It's not like you're learning something about how nature works, although you may learn a whole lot if it succeeds."

In other words, SETI is a gamble, an all-or-nothing Las Vegas slot machine with the payoff hidden somewhere among the stars. If the odds of winning are so incredibly long, why would anyone spend years trying?

"What keeps people going," says Frank Drake, "is the magnificence of success." Drake, now 65, serves as president of the nonprofit SETI Institute, which occupies a collection of rented office space in Silicon Valley. In his mind, a message from extraterrestrials would be "the greatest discovery. It would change our lives and our future. It's just a very dramatic goal."

There are a few dozen scientists with their eyes on that goal, and it's easy to imagine that the SETI community would be rife with competition. Instead, says Drake, "The culture of SETI is one of people cooperating, stimulating, and encouraging each other. There's no sense of competition or rivalries."

Well, almost none. When it comes to funding—by far the most difficult part of SETI—good will can become strained. Says Horowitz, "Sometimes you don't get the money you like, or someone else's experiment seems to be getting more press than you think it deserves."

At the University of California at Berkeley, Stu Bowyer heads a program called Serendip, which uses a 4-million-channel receiver attached to the world's largest radio telescope, the 1,000-foot dish at Arecibo in Puerto Rico. Until a couple of years ago, Serendip was receiving NASA funds, but that changed in 1993 when Congress killed the agency's SETI program. Since then, Bowyer has chafed at the amount of money and publicity he sees other SETI programs getting. Says Horowitz, "You don't read about the Serendip group a lot, but they're doing absolutely terrific work."

But publicity brings its own headaches, including the so-called giggle factor, caused by the pervasive misperception that SETI somehow is linked with UFO enthusiasts. At the SETI Institute, Drake says, it touches a raw nerve. "You say 'UFO' around here and everybody clenches their fists.... It's something we fight all the time." It can feel like a losing battle. Drake cites polls showing that "60 percent of the American people say that UFOs are from other planets and that aliens have landed on Earth." Whenever he makes a public appearance, Drake has a close encounter with UFO enthusiasts who hope he will confirm their beliefs. When he doesn't, says Drake, they often conclude he's "part of the big government cover-up." Cruising the

ANDREW RANKIN/WILDNIGHT

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Internet recently, Drake found himself the subject of a bizarre theory: "They claim that I'm the curator of captured alien bodies. That I have them stored somewhere. That I dissect them." Drake laughs. "I have no medical training at all. I wouldn't know how to dissect a frog, let alone an alien."

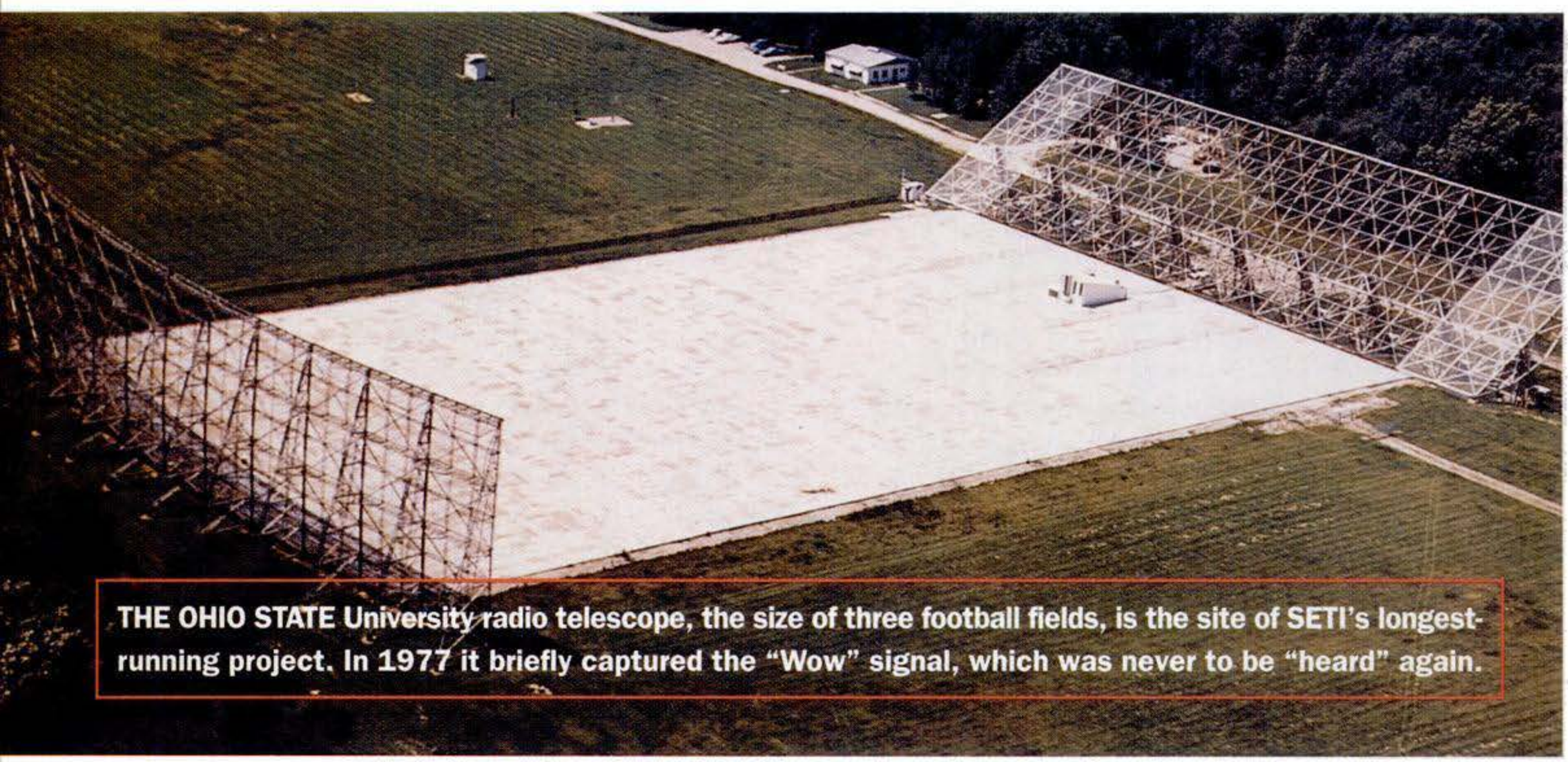
In Congress, meanwhile, the giggle factor has helped make SETI an easy target for budget-cutting lawmakers. In 1992, the year NASA's High Resolution Microwave Survey began operations, Nevada's junior senator, Democrat Richard Bryan, mounted a one-man assault that was turned back by SETI's friends in Congress. The following year, says Seth Shostak, Bryan "succeeded in getting it axed—not cut 20 percent or a horrific 50 percent, but axed completely," purportedly as a way of helping trim the budget deficit. In truth, he adds, the money amounted to "one tenth of 1 percent of the NASA budget. It had absolutely no impact on the budget. It was a nickel per year for taxpayers." But SETI allies, caught by surprise, had no time to mobilize support; they even noted that some senators who participated in the vote had no idea what it was about.

Sen. Barbara Mikulski, D-Md., a longtime SETI supporter, was quoted as saying, "It's the giggle factor. We can't win this one." Bryan's press release claimed that he had single-handedly stopped "the Great Martian Chase."

Three days after the vote, Drake and his SETI Institute colleagues were already planning a comeback strategy. Within a year, they had created Project Phoenix, the most comprehensive and expensive SETI program ever undertaken; its goal is to survey 1,000 nearby stars over the next several years. This fund-raising coup was largely due to the efforts of the Institute's Barney Oliver, a former Hewlett-Packard vice president who raised $7.3 million in donations, mostly from four high-tech moguls, including founding members of Hewlett-Packard, Microsoft, and Intel.

But it was also due, in large measure, to the persistence of astronomer Jill Tarter. Now 51, Tarter has been involved with SETI since the early 1970s. Says Horowitz, "She's got incredible stick-to-it-iveness.... It's unbelievable what she's willing to go through for SETI." Indeed, she has dedicated her whole career to it.

Tarter seems to embody Stu Bowyer's view that "science is by nature both competitive and collaborative." Ask her which SETI team is likely to succeed, and she answers, "I'd obviously be working for the group that I think has the best chance." At the same time, she says of the others, "I don't view them as competitors," adding that she is eager to support them, both in spirit and with funds. She hopes the SETI Institute will be able to raise enough money to put together an endowment that would support any innovative, serious search.



THE OHIO STATE University radio telescope, the size of three football fields, is the site of SETI's longest-running project. In 1977 it briefly captured the "Wow" signal, which was never to be "heard" again.

By her own admission, Tarter is not good at politics: She can be impatient with people who don't see her point or can't keep up with her intellectually. Drake acknowledges, "She can be abrupt, unpolitic," but he adds, "She's learning to restrain herself. And she's getting better at that."

To Tarter, the knowledge of the very existence of an advanced extraterrestrial civilization would come as a welcome sign that we have a chance of surviving our own technological adolescence instead of vanishing. That's why all of this will be worth the effort, she says, "even if the message is only a dial tone." Still, Tarter doubts she will live to hit the SETI jackpot. "This could well be a

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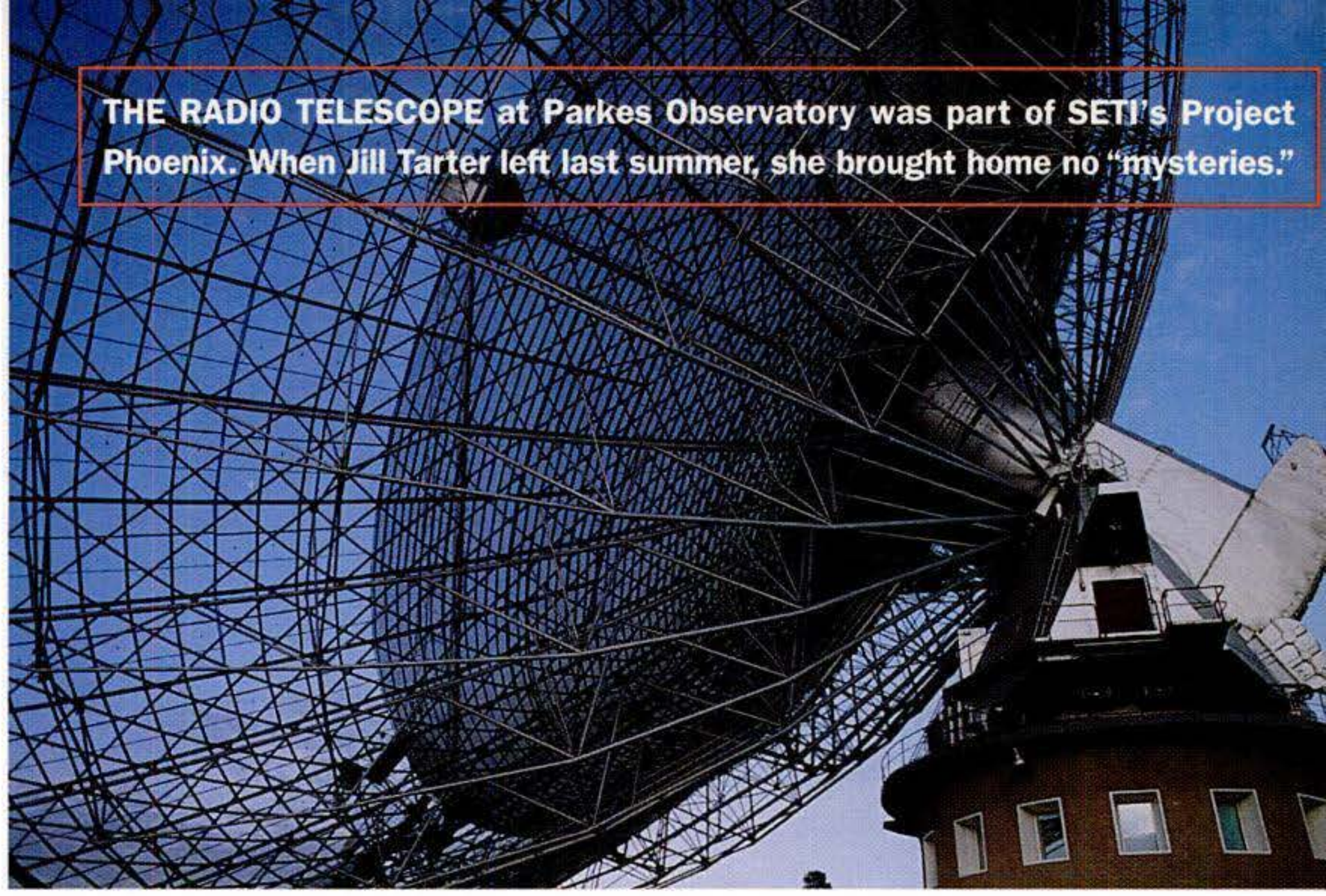

THE RADIO TELESCOPE at Parkes Observatory was part of SETI's Project Phoenix. When Jill Tarter left last summer, she brought home no "mysteries."

project that my granddaughter succeeds at," she says. For that reason, says Tarter, SETI might signal "a maturing phase in [our] civilization—that perhaps we're willing to undertake what may be a very long-term project, simply because we're curious, not because somebody said, 'Go build those cathedrals.'"

LAST JANUARY, Tarter and a contingent of engineers arrived at the Parkes radio observatory in southeastern Australia for Phoenix's inaugural observing run. For Tarter, it meant some unanticipated tasks: keeping the engineers supplied with Diet Coke and chocolate, giving orientation lectures concerning the observatory's ecologically friendly toilet (as well as some decidedly unfriendly spiders and snakes), or rousting technicians out of bed with middle-of-the-night phone calls. Tarter does not especially enjoy interviews, but the country's media came to Parkes in force, including Australian TV's equivalent of "Nightline," complete with a Ted Koppel look-alike.

And then there were the flies. Parkes is located near a sheep farm, and the flies are so thick that you have to wave your hand in front of your face as you walk, a maneuver known as the Australian Salute. But the toughest part, Tarter says, was the search itself.

"The romanticism went out of this, in some sense, a long time ago. This is hard work. We're bringing up new technology in an environment where our support base is 8,000 miles away. You use a radio telescope 24 hours per day, which means that we're struggling with it, if it isn't behaving, through all hours of day and night." As Tarter sees it, "Tenaciousness is probably more the ingredient than romance."

It was all worth it. The night sky above the Australian outback is sprayed with stars, so many that her belief in SETI was reaffirmed whenever she looked at them. And by the time they left Australia in July, Tarter's group had observed some 200 stars. Not surprisingly, no extraterrestrial signals turned up, although there were plenty of false alarms that set the group's hearts pounding. But unlike other surveys, Phoenix's detection system—which had the advantage of using two widely spaced telescopes—consistently weeded out the impostors, usually distant Earth satellites. Tarter says proudly, "We didn't come home with any mysteries."

But Tarter and her colleagues came home to an uncertain future; they have yet to secure either the funds or the site for further observations. Meanwhile, two other searches are in danger of being shut down for lack of funds. Stu Bowyer was able to keep Serendip going for some time after his NASA funding was canceled, because, he says, "I got a big chunk of money from my mother." But now, he laments, "Unless we get some money, we're about to be shut off." Asked what he would do in that eventuality, Bowyer says quickly, "I'm not going to think about that."

At Ohio State, whose search equipment was recently upgraded to include one of Serendip's 4-million-channel receivers, it all comes down to paint. The land on which the OSU telescope resides is leased from a private landlord who would like to get rid of his tenants and their antenna, which is about the size of three football fields, in order to build a housing complex. As Bob Dixon explains, "One of the clauses in the lease is that we're required to paint the telescope." OSU's president has refused to allocate the $285,000 necessary for the job. The chairman of the engineering department offered to cover the cost out of his own budget, only to be overruled by the administration. Volunteers have already started repainting the base of the telescope, Dixon says, but he's reluctant to let them tackle the high parts; it's too dangerous. Unless someone comes up with a cherry picker and a supply of paint, OSU's antenna may be demolished within a few years.

The search for extraterrestrial intelligence, says Drake, is "a tough road. But once you're in it, you don't want to leave it." In Cambridge, Horowitz agrees. For him, SETI has some of the same allure he felt with amateur radio, but on a far grander scale. "You're building this tremendous bridge across 4 billion years of evolution. The end of our Earth's cultural isolation. That's heady stuff. It will do all those things when it happens. I think *when*, not *if*." Until then, if anyone wonders what sustains him, Horowitz has a ready answer: "We know they're out there. Ours is the first generation that has the ability to look. We'd be crazy not to try. It's that simple."◆

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Winging It Down Under

Sailing a catamaran at 30 knots is like swimming and flying at the same time. BY RICHARD STEPLER

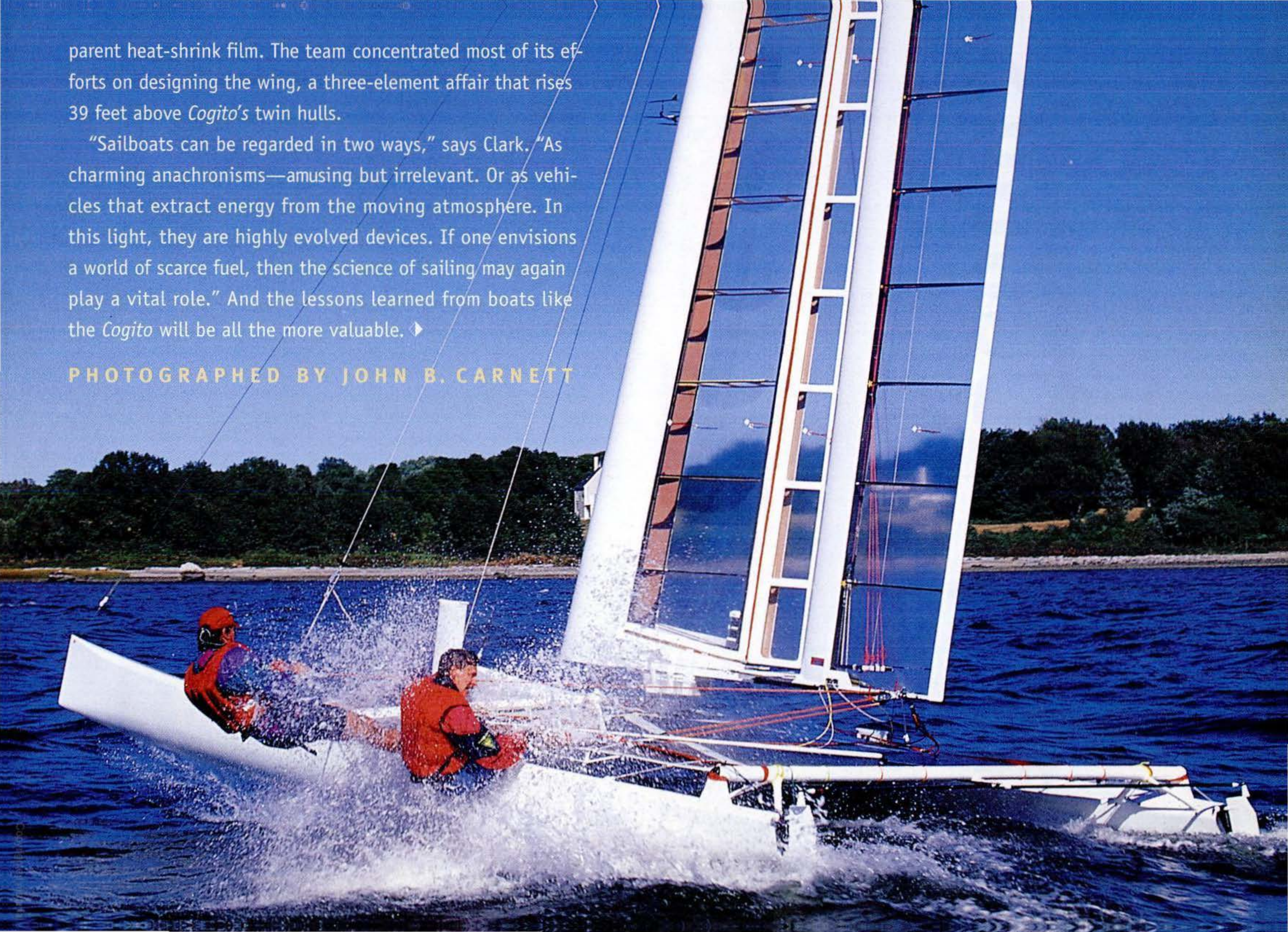
FOR 10 YEARS AUSTRALIA has held the International Catamaran Trophy, better known as the Little America's Cup. This January, an American team led by Rhode Island boat builder Steve Clark hopes to wrest the cup from Australian Lindsay Cunningham. Clark will field the *Cogito* at Port Philip Bay near Melbourne.

Sometimes described as a history of breakthroughs and breakdowns, Class C catamarans represent the cutting edge of sailboat design, pushing the limits of efficiency and speed ever higher. In fact, the only parameters specified relate to size: The catamaran must be 25 feet long, be no more than 14 feet wide, and carry a sail of 300 square feet. Solid wings have replaced soft sails on these boats since the mid 1970s; the airfoils allow the catamarans to reach 30-knot speeds. Weight reduction has also been a top priority. The first Class C cats of the 1960s weighed 1,000 pounds; today's boats tip the scales at less than 400. Clark's team used computers extensively to design and test the *Cogito*, a 385-pound creation of carbon fiber, fiberglass, Nomex honeycomb, and .005-inch-thick trans-

parent heat-shrink film. The team concentrated most of its efforts on designing the wing, a three-element affair that rises 39 feet above *Cogito's* twin hulls.

"Sailboats can be regarded in two ways," says Clark. "As charming anachronisms—amusing but irrelevant. Or as vehicles that extract energy from the moving atmosphere. In this light, they are highly evolved devices. If one envisions a world of scarce fuel, then the science of sailing may again play a vital role." And the lessons learned from boats like the *Cogito* will be all the more valuable. ◆

PHOTOGRAPHED BY JOHN B. CARNETT



By Don Sherman

Researchers make an amazing discovery: One-wheel braking is the key to computer-controlled vehicle dynamics.

The Spin Doctors

DOES WINTER driving give you cold sweats? Do you blanch at the thought of fishtailing on slippery roads? If you dread rain-slicked roads and fret over frosty curves, you're a perfect patient for the spin doctors. These specialists may not be accredited by any medical organization, but their cure is undeniably fast-acting and effective. In mere milliseconds, the spin doctors' therapy goes to work, guaranteeing you peace of mind behind the wheel.

Their remedy makes your car go exactly where you point it with the steering wheel. Rear wheels track obediently behind the front ones. Scary spinouts are all but impossible. I know because I journeyed to Arctic Circle proving grounds twice last winter to test the cure on frozen lakes in Sweden.

Imagine being able to set and hold the steering wheel through a curve while the throttle is held flat to the floor on glare ice without twirling out of control. Two demonstration vehicles carved such an arc at 40 mph, each as stable as a freight train with an electronic lock on the path selected by the driver. Obviously, this milestone in automotive safety goes far beyond the old winter-driving home remedies—snow tires, chains, and bags of sand in the trunk.

This new technology will eventually be marketed under various names. Mercedes-Benz, the first manufacturer to offer such a system

INFOGRAPHICS BY JOHN GRIMWADE

DRIVING WITH STABILITY CONTROL

EVERY MICROSECOND, using electronic sensors and computer **logic, the** Robert Bosch GmbH/Mercedes-Benz Electronic Stability Program (ESP) calculates whether the car is proceeding in exactly the direction it is being steered by the driver. If there is any difference between what the driver is asking—via the steering wheel—and what the car is doing, ESP corrects by automatically applying one or both of the left- or right-side brakes.The system uses the speed of the four tires and steering wheel angle to calculate the direction steered, and it receives data on lateral G's and vehicle yaw to measure what the car is actually doing. ESP measures any tendency toward understeer—when a car is slow to respond **to** steering changes—or oversteer—when the rear wheels try to **swing** around. ESP maintains directional stability on smooth or **uneven** surfaces and on patchy snow, ice, or gravel.

UNDERSTEER

The car is slow to respond to steering changes in a turn.

OVERSTEER

The rear wheels of the car try to swing around.

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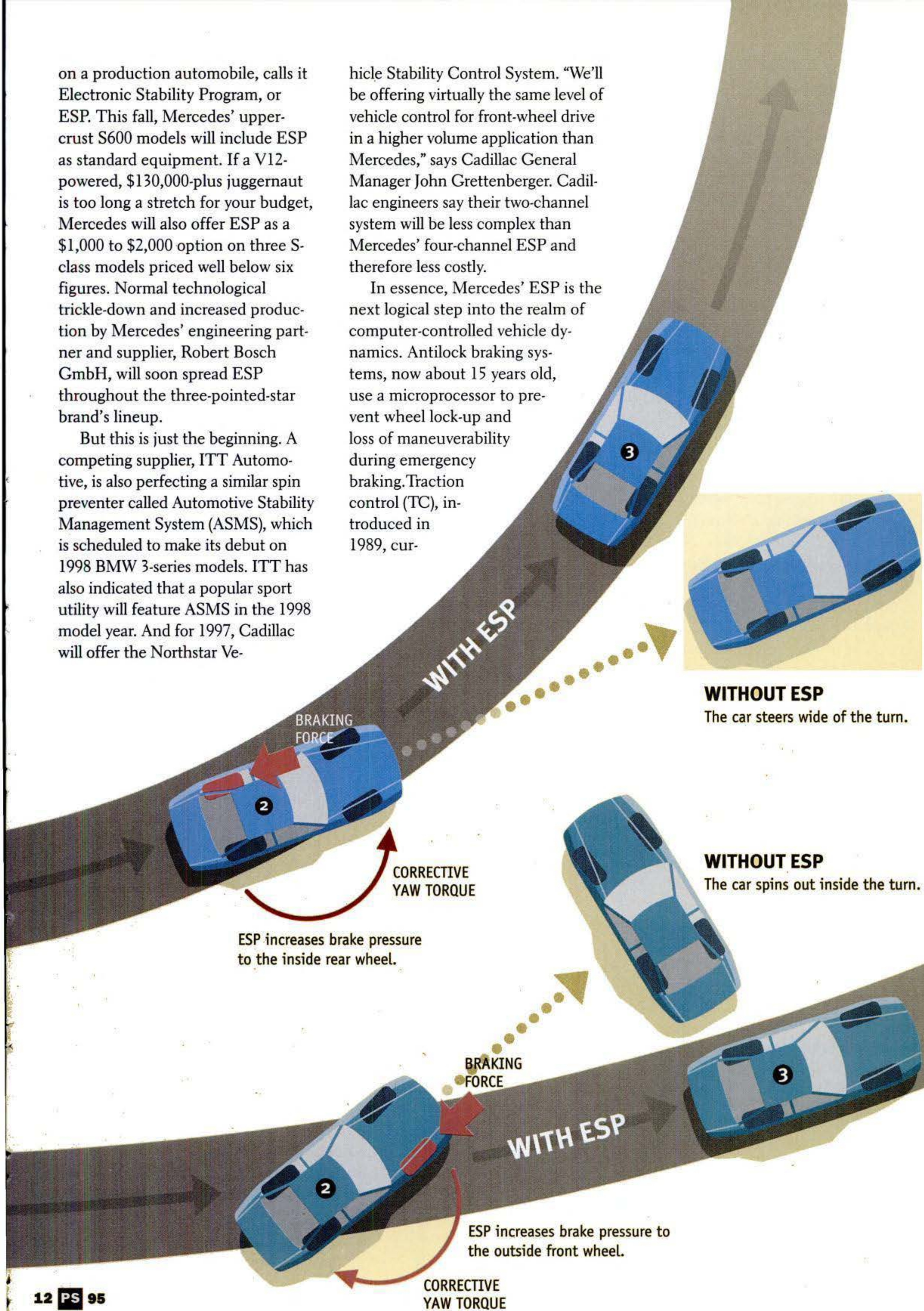
on a production automobile, calls it Electronic Stability Program, or ESP. This fall, Mercedes' upper-crust S600 models will include ESP as standard equipment. If a V12-powered, $130,000-plus juggernaut is too long a stretch for your budget, Mercedes will also offer ESP as a $1,000 to $2,000 option on three S-class models priced well below six figures. Normal technological trickle-down and increased production by Mercedes' engineering partner and supplier, Robert Bosch GmbH, will soon spread ESP throughout the three-pointed-star brand's lineup.

But this is just the beginning. A competing supplier, ITT Automotive, is also perfecting a similar spin preventer called Automotive Stability Management System (ASMS), which is scheduled to make its debut on 1998 BMW 3-series models. ITT has also indicated that a popular sport utility will feature ASMS in the 1998 model year. And for 1997, Cadillac will offer the Northstar Vehicle Stability Control System. "We'll be offering virtually the same level of vehicle control for front-wheel drive in a higher volume application than Mercedes," says Cadillac General Manager John Grettenberger. Cadillac engineers say their two-channel system will be less complex than Mercedes' four-channel ESP and therefore less costly.

In essence, Mercedes' ESP is the next logical step into the realm of computer-controlled vehicle dynamics. Antilock braking systems, now about 15 years old, use a microprocessor to prevent wheel lock-up and loss of maneuverability during emergency braking. Traction control (TC), introduced in 1989, cur-



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tails wheel spin and loss of directional stability during acceleration on slippery surfaces. ABS and TC do a fine job of stabilizing vehicle dynamics during straight-line driving. ESP's mission is to close the loop by greatly magnifying the driver's ability to maintain control in the cornering mode.

Since cornering dynamics are far more complicated than straight-line vehicle motion, ESP demands major additions in both hardware and software. **According to Mercedes, ESP requires twice as many algorithms as ABS and TC combined.** ESP works by comparing where the driver wishes to go with where the vehicle is actually going. In the event a discrepancy exists, ESP commandeers both the powertrain and the brake system to resolve differences. From its name, you might imagine that ESP has the ability to read the driver's mind. That is not the case, however. To identify where the driver wishes to go, ESP uses the simple expediency of a steering-wheel-position sensor.

The other half of the equation is the need to know exactly where the car is going at any instance. The general heading for this battery of information is vehicle dynamics. It consists of a multitude of data points, two of which are velocity and lateral acceleration. Another critical factor is what engineers call yaw rate, a term that begs explanation.

Yaw refers to the rotation of the vehicle about a vertical axis. Imagine a car model with a toothpick stuck through the roof. That toothpick is the yaw axis. Twirling the toothpick between your fingers produces yaw motion, and spinning the car model more quickly increases the yaw rate. Since yaw rotation is analogous to a spinout on ice, it's obvious why engineers are especially interested in this particular piece of information. By sensing vehicle speed, lateral acceleration, and yaw rate, the ESP computer is able to compare the car's dynamic performance with a mathematical model stored in memory. The next step is determining if that performance accurately matches the driver's intentions. For the most part, this boils down to steering wheel position versus yaw rate. When the front wheels begin to slide and the cornering path is wider than the driver desires, a condition called understeer exists. The ESP computer registers a yaw rate smaller than what the driver ordered according to steering-wheel position. Oversteer, on the other hand, is the term used to describe a loss of traction at the rear of the car. When the tail slides wide and the cornering arc is tighter than desired by the driver, the ESP computer registers a yaw rate too high to concur with steering-wheel position.

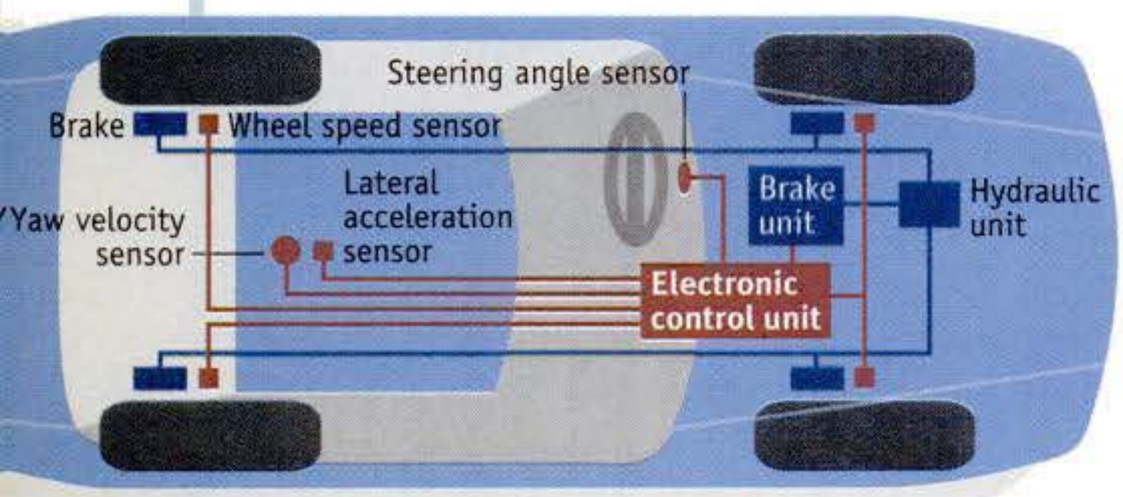
During normal maneuvers with the driver in full control, yaw rates are low. For example, when POPULAR SCIENCE testers circumnavigate a 300-foot-diameter dry asphalt skidpad at the limit of a car's cornering adhesion, it typically takes 15 seconds for the car to complete one 360-degree lap. The average yaw rate in this instance is 24 degrees/second (360 degrees divided by 15 seconds), which represents a rough upper limit for a controlled yaw rate.

During an out-of-control spinout, the yaw rate is far higher. For example, a hand-brake-induced "doughnut" on fresh snow can reverse a car's heading in less than a second. That corresponds to a yaw rate of 180 degrees/second (180 degrees divided by one second). A yaw rate that's too low can also signal an out-of-control condition. When the car plows wide of the curve due to a loss of front-wheel traction, the yaw rate would fall to just a few degrees per second or even less. Sensor information is updated every 40 milliseconds so ESP can take action long before the car slides very far out of line.

Even more interesting than how ESP knows the driver needs help is the means by which assistance is delivered: It's done by automatic one-wheel braking, a strategy that may seem bizarre but is nevertheless eminently effective.

When ESP determines that the vehicle is cornering with a yaw rate that's too low or too high, it orders a direct and immediate fix through the braking system. Working in concert with ABS equipment and with absolutely no braking by the driver, ESP generates the necessary hydraulic pressure and routes it to the corner of the car where it will do the most good. This results in what engineers call a corrective yaw torque: a force applied through one tire contact patch to speed up or slow down the car's yaw rate.

For example, if the car is understeering around a left-hand bend, ESP orders a momentary application of the left-rear brake. This "helps" the



The Components of Stability Control

THE MERCEDES-BENZ/ROBERT BOSCH Electronic Stability Program utilizes existing ABS and TC components, including wheel-speed sensors and the car's disc brakes, along with its hydraulic system. There are significant hardware and software additions, as well: New sensors measure steering wheel angle, yaw velocity, and lateral acceleration, while two new microcomputers, each with 48K of memory, are four times as powerful as the ABS controller.

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The author carves an arc on glare ice at 40 mph at an Arctic Circle proving ground in an S-class Mercedes-Benz.

car make the turn by increasing the yaw rate in the counterclockwise direction (viewed from above). When ESP detects an oversteer condition, one front brake is engaged to diminish the yaw rate. For example, if the tail swings wide in a left-hand bend, ESP commands the momentary application of the right-front brake to move the car back in synch with the driver's desires.

This simplified explanation by no means covers the multitude of subtleties and contingencies that are programmed into the complex ESP system. For example: ESP also has authority over the powertrain. When necessary, the amount of torque delivered to the rear axle is reduced by closing the throttle, retarding ignition timing, or upshifting the transmission. In this regard, ESP works just like traction control. A drive-torque reduction is typically the first action ESP takes. In the event that one-wheel braking doesn't generate a sufficient yaw-torque correction to stabilize the maneuver, ESP automatically engages a second brake on the same side of the car.

In order to react quickly, ESP anticipates how much hydraulic pressure to deliver to the brakes. It determines this by constantly calculating the drive torque delivered to the rear wheels. This tells ESP the coefficient of friction between the tires and the road and exactly how much brake pressure is needed for an effective yaw-torque correction.

One or more brakes can be engaged without the driver pressing on the brake pedal by means of an electrically driven hydraulic pump and pressure accumulator. ESP also works during braking and is especially helpful in split-mu conditions (one track on dry pavement, the other on ice).

Under normal circumstances, ESP does nothing. The car's accelerating, braking, and cornering performance is not diminished in any way. Assistance is provided only when traction limits are exceeded and the driver is on the verge of losing control.

Driving ESP prototypes 600 miles north of Stockholm was a memorable experience. Snow was piled high at the edge of the roads leading to the Lake Hornavan test track, but a hazard lurked within the soft barrier: an unforgiving steel guard rail. In convoy, the squadron of S-class models drove rapidly nose-to-tail in spite of harsh winter conditions and slippery surfaces underfoot. It took exaggerated sawing of the wheel to trigger ESP. When it went to work, the only sensations were a soft thumping deep within the car's bowels and an uncanny resistance to wobbling. The same reckless steering inputs with ESP off provoked immediate fishtailing that demanded aggressive steering corrections to avoid an expensive crunch into the guard rail.

At Lake Hornavan, the most dramatic demonstration opportunity was fast laps around a 200-meter circle carved into the ice. With the steering wheel held a few degrees to the left and the throttle locked to the floor, the big Benz accelerated until it stabilized at 40 mph. With the ESP warning lamp flashing and muted sounds from the braking system, the car cornered as if restrained by an invisible tether. Less steering lock resulted in a slightly larger arc and a speed increase. Dialing in more steering lock automatically slowed the car as ESP activated the inside brakes to help the Mercedes tighten its arc.

ESP functions almost transparently, demanding only one thing from the driver: trust that it works. I found that was a lot to ask in one procedure: the classic accident-avoidance maneuver. Mercedes used a pop-out mannequin to simulate a highway emergency. Dodging this surprise object in the road required moving left into the oncoming lane around the dummy and then back to the original path. Traffic cones defined the outer edges of the road.

Quick left-right accident-avoidance steering is inevitably followed by a delayed reaction at the back of the car. When the maneuver is made on a mixture of packed snow and ice, great care must be exercised to keep the tail from looping around and spinning the car out of control. In this case, that care takes the form of countersteering to the left to keep the tail in line. On my first pass with ESP disabled, that worked perfectly: I missed the mannequin and steered back to my lane, avoiding the traffic cones at the inner and outer edges of the course.

The second pass with ESP active was not so successful, however. The proper steering would have been to the left and then to the right with no extra corrections. I entered the left-right commands, but I also instinctively added a touch of corrective left steer to thwart a tail slide at the exit of the course. With ESP active, when I steered left the car went left, mowing down a row of cones. Ingrained instincts die hard.

Even though electronic stability control will take some getting used to, there's absolutely no doubt that this is a significant step toward the crash-proof automobile. Spinouts are virtually impossible. Simple steering and braking inputs generate the expected response with no added monkey motion. The chassis works wonders to give drivers of any skill level a substantially higher degree of control. Incremental gains in vehicle performance have been eclipsed by a quantum leap in the ability to use all of the available traction. ◆

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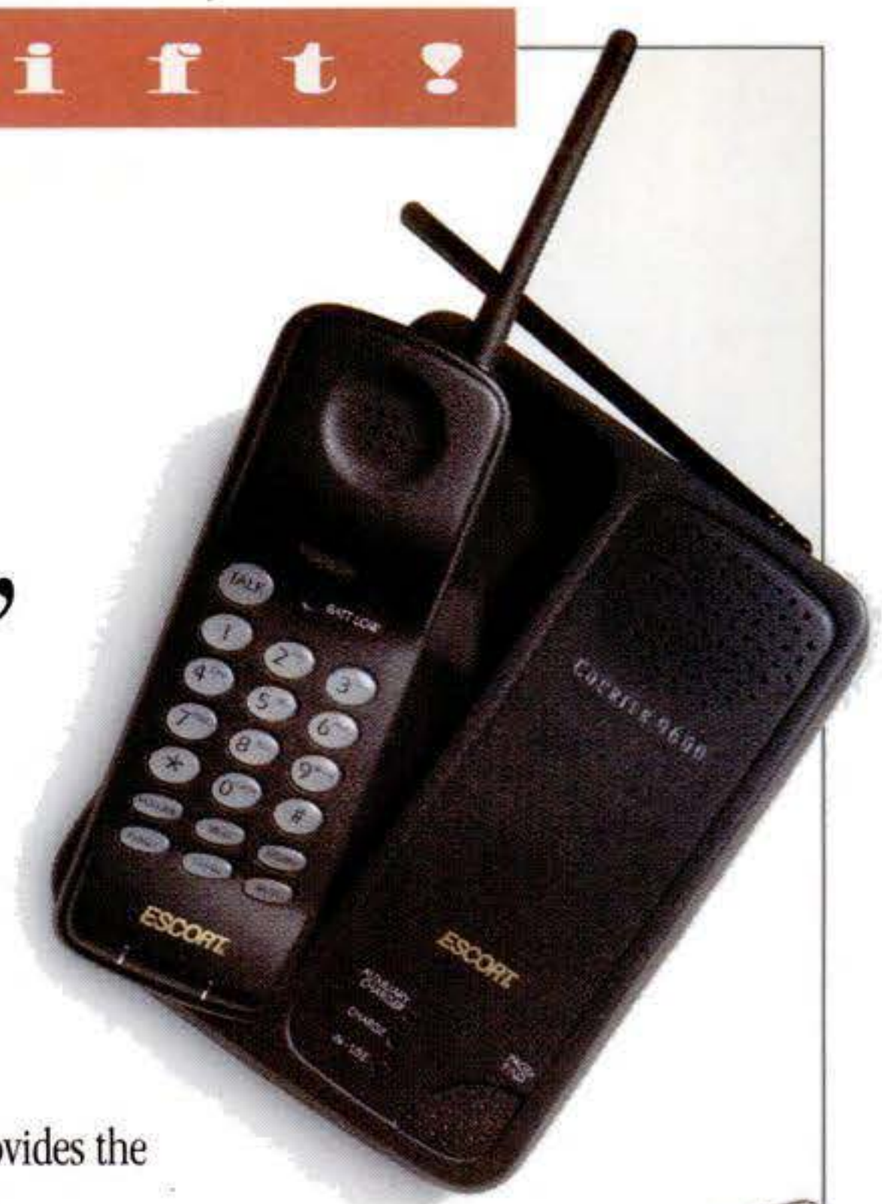

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ASK POPULAR SCIENCE

I understand that 9 Gs is about the maximum a pilot can withstand without breaking blood vessels. How does a flying suit squeeze the pilot's legs and torso in order to keep blood in his upper body?

William Bell
Springfield, Ore.

AS A MODERN fighter plane rolls and dives through abrupt combat maneuvers, G-forces build up almost instantaneously on the aircraft's structure and on the pilot's body. Human physiology sets the limit. Brief periods of 9-G loading are all that even a highly trained pilot in excellent physical condition can tolerate—and that's while wearing a "G-suit." This device has air bladders around the abdomen and lower legs that quickly inflate with air when a sensor detects G-loads that would drain the blood supply from the pilot's head, risking a potentially lethal episode of "G-induced loss of consciousness," or G-LOC, as aerospace medical specialists call it.

The air bladders constrict the flow of blood toward the pilot's lower body, thus maintaining sufficient blood pressure in the brain. The trend in G-suit design is toward garments with more

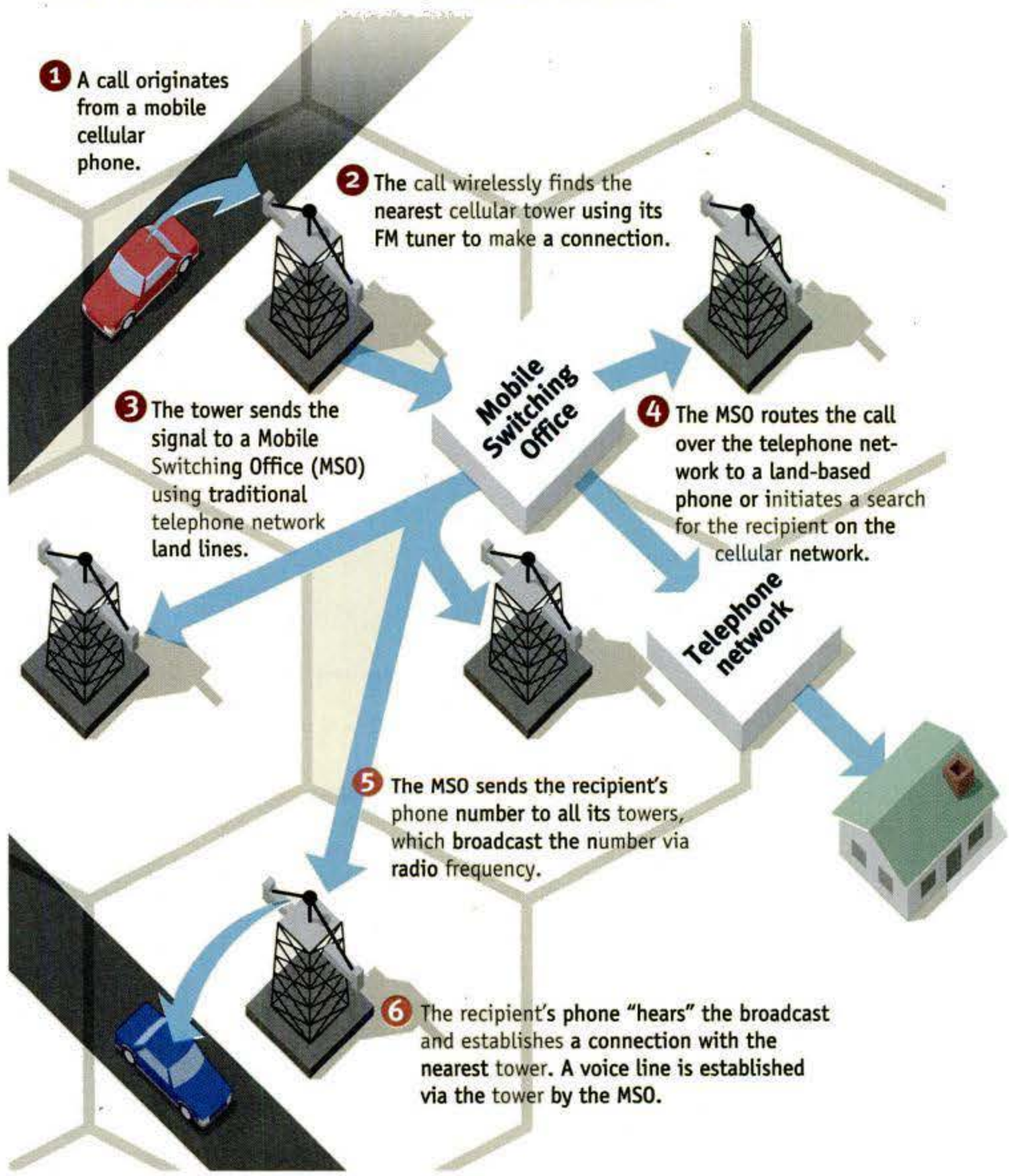
Air Force G-suit.

GREGORY WAKABAYASHI

HOW IT WORKS

The Cellular Phone

WHAT HAPPENS WHEN you place or receive a cellular phone call? The illustration below outlines how your call is routed to a traditional phone or to another cellular phone with the same carrier service. (When you take your phone out of your local service area, you usually have to register with another cellular provider.) When placing a call to another cell phone that buys service from a different provider, the call is routed through a long distance carrier (MCI, AT&T, or Sprint, for example), and is then sent through the recipient's cellular carrier as described below.—*Suzanne Kantra Kirschner*



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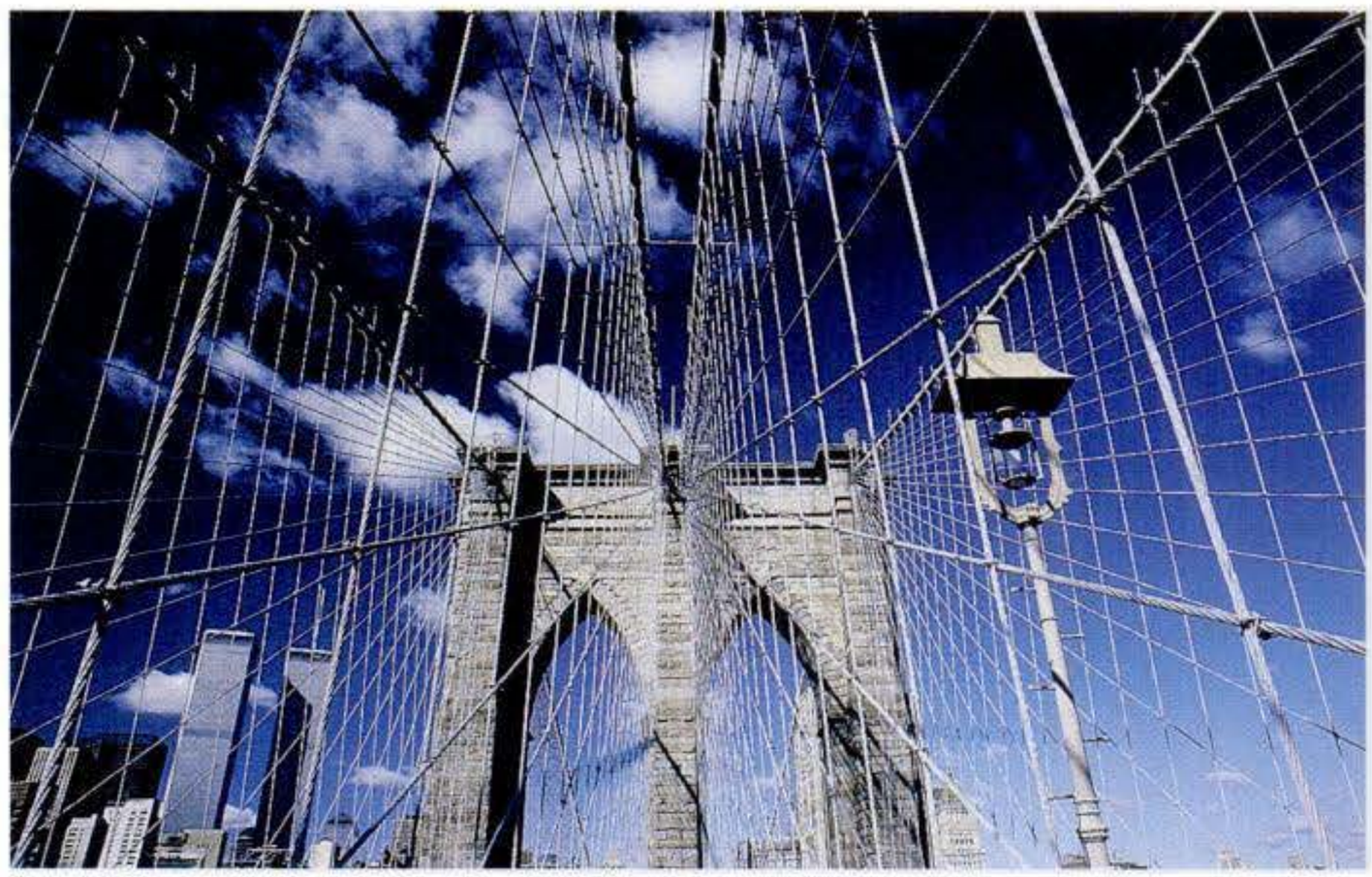
THE FACTS

Engineering Marvels

TODAY WE TAKE for granted the passageways above and below our rivers and streets that enable us—and our waste—to travel from here to there. But what do we really know about our bridges, dams, and tunnels? Read on for a sampling of surprising details on these engineering marvels.
—compiled by Michael Weber



TONY STONE WORLDWIDE/JON ORTNER

The Brooklyn Bridge, with a span of 1,595 feet between its towers, opened on May 23, 1883.

In 2160 B.C., Queen Semiramis ordered the construction of the first known underwater tunnel. Built of brick and tar, the tunnel joined the two fortified halves of the ancient city of Babylon. Nearly 4,000 years would pass before the next known underwater tunnel was constructed, under England's Thames River. Originally for carts, the British tunnel is still in use—for the subway.

New York City has 6,200 miles of sewer tunnels—about the equivalent of the round-trip drive from Boston to San Francisco.

In the 1960s, the air pressure in Japan's 33.5-mile Seikan railroad tunnel between the islands of Honshu and Hokkaido was so great that workers could remain in the tunnel for only one of every eight hours or risk suffering "the bends," a potentially fatal condition caused by the release of gas bubbles in tissue upon ascending too quickly from the greater pressures underwater.

Each of the twin cables in San Francisco's Golden Gate Bridge weighs 7,125 tons and is more than a yard thick. One cable is made up of 27,450 wires—or more precisely, 61 strands of 450 wires each.

Dams account for 98 percent of the water storage capacity in the U.S.

Covered bridges were designed to protect the structure from the elements—not to prevent horses from bolting, as was commonly believed.

A tunnel linking France and England was first proposed in 1802, but Napoleon expressed no interest in it. Later proposals were ignored until 1882, when a British engineer built a machine that could cut through 39 feet of chalk every 24 hours. After one mile of tunneling, though, the project was halted when fears of a French invasion swept through Britain. (The Channel Tunnel, linking Coquelles, France, and Folkestone, England, opened in May 1994.)

The two towers of the Verrazano-Narrows Bridge are 1⅝ inches farther apart at the top than at the bottom because of the curvature of the Earth. Each tower contains 3 million rivets and 1 million bolts. Connecting the New York City boroughs of Brooklyn and Staten Island, the bridge boasts a span of 4,260 feet—slightly longer than that of the Golden Gate. It contains enough concrete for a single-lane highway from New York to Washington D.C.

The Manhattan Bridge, spanning New York's East River, rises and falls up to nine feet under heavy traffic.

Until the 1980s, tourists could take subterranean boat tours of Parisian sewers. What an evening in Paris!

On average, dams lose 1 percent of their capacity to sedimentation every five years. The Kulekhani Dam in Nepal, however, will completely fill in around the turn of the century, rather than between 2075 and 2100 as originally expected when the dam was completed in 1981. And the reservoir behind the 250-foot-high Warsak Dam in Pakistan lost 40 percent of its capacity five years after it was completed in 1961. By 1980, only a narrow channel remained leading to the water intakes.

John A. Roebling's efforts to build the Brooklyn Bridge were spurred by the brutal winter of 1866-'67, when ferry service between Brooklyn and Manhattan was severely disrupted. Ironically, in 1869 a ferry crushed Roebling's left foot and he died of tetanus poisoning. His son then took over and the bridge opened in 1883.

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inflatable area and smarter sensors and inflation valves that apply the needed pressure at the right moment and area of the body. Positive-pressure oxygen masks that help the pilot's lungs fill against the huge pressures of high-G flight are another method being explored.

The overall goal is to enable pilots to safely fly multiple high-G missions in one day. High-G flight is a physically draining activity that today's pilots must recover from before more turning, burning, and loading up with Gs.

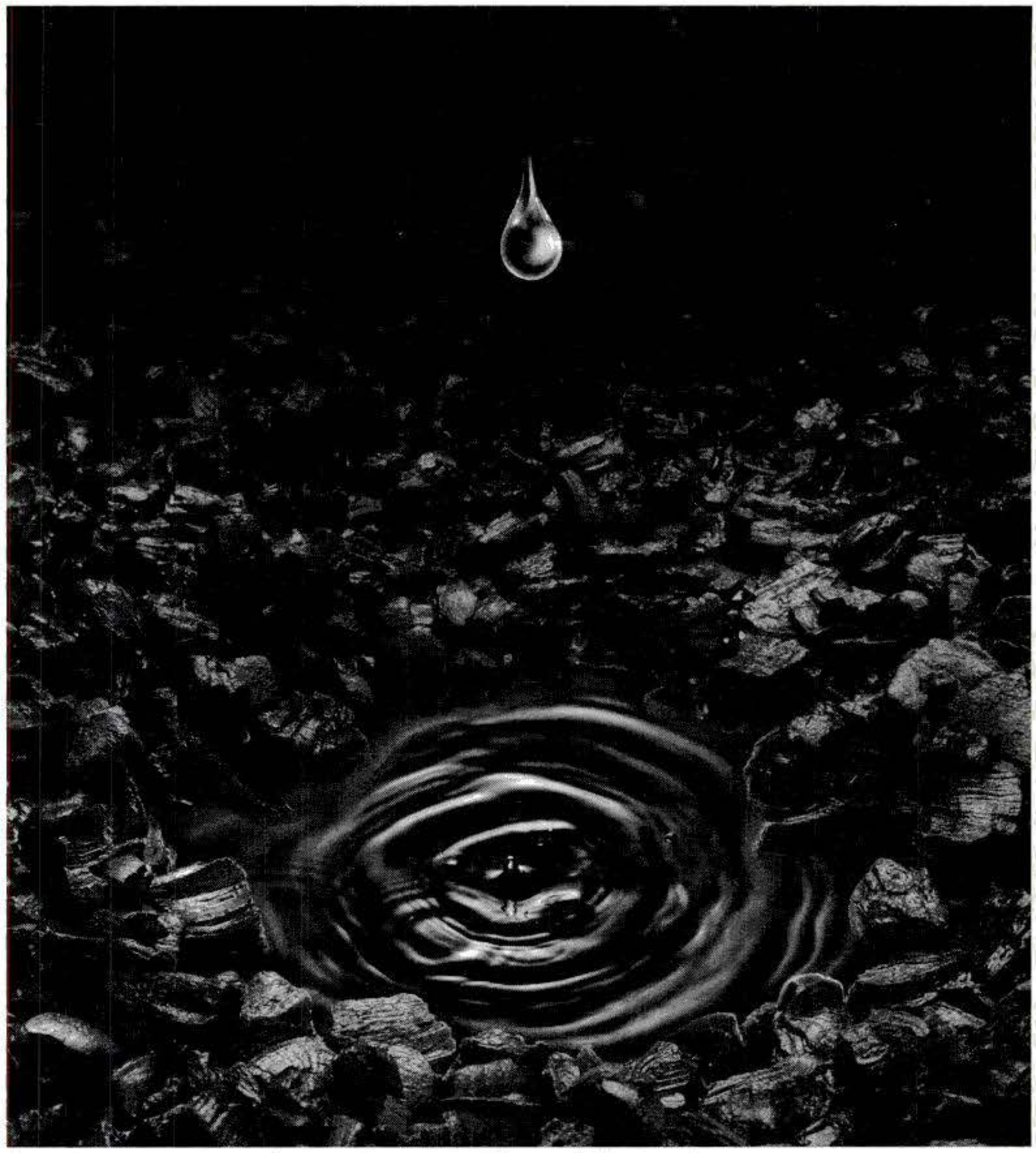
How does the World Wide Web find information when you click on a word or picture?

Hanes1234@aol.com

IT USES A VERY big phone book. The World Wide Web is what's known as a distributed system—the information is stored on many connected computers rather than one central system. On the Web, these computers are spread out across the planet, forming a maze of linked points that resembles a massive spider's web—hence the name.

The highlighted words and pictures on Web pages are actually "hyperlinks," or requests to retrieve another Web page. The hidden hyperlink includes the exact electronic address of the new Web page, which could be stored in a computer down the road or across the ocean. When you click on a hyperlink, your primary Web computer, or "server," quickly searches its massive list of other Web servers and addresses and uses these "pointers" to find the right location. It then goes out and gets the page you requested.

Though it appears you're "on" a different Web site every time you receive a new page, you're not. The data comes to you. So while it may seem like you're jetting around the globe as you use the Web, it's more like switching channels on the TV.



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Is it true that you blink your eyes when you sneeze? And if so, why?

R1ichard@aol.com

YES, YOU DO blink when you sneeze. Sneezing is an involuntary reflex to irritation in the nasal passages. When a sneeze begins, two motor functions are activated: the facial nucleus, a contraction of muscles, which causes the eyes to close, and the nucleus ambiguus, which causes the vocal cords and palate to close, directing air through the nose. It's obvious why your vocal cords and palate close. What advantage closing your eyes provides when you sneeze is not clear, however.

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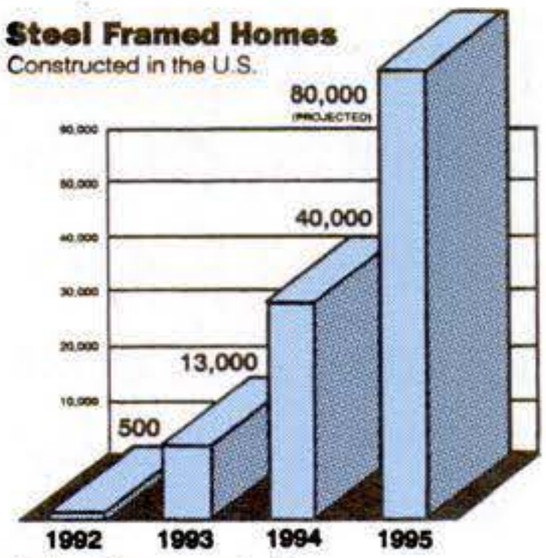

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How did the term 4x4 come to be used as shorthand for four-wheel drive? And if a two-wheel-drive vehicle is a 4x2, would that make a bicycle a 2x1?

Debra Malmgren
Caldwell, N.J.

THE TERM 4X4 (four by four) is an old Army designation. The first number refers to the number of wheels and the second to the number of driven wheels. Although 6x4 and 4x4 are the most common, 2x1 would, in fact, be a bicycle.

One other bit of related trivia: The word jeep comes from GP, the model-development symbol for the first jeep from Ford Motor Co.

What is the latest news on HDTV technology and when does the industry expect to begin delivering HDTV sets and broadcasts?

KelleyM260

FEDERAL Communications Commission testing of an HDTV broadcast standard should be completed soon. The technical specification was put forth by the Grand Alliance, a consortium of companies that built the new television system. Though HDTV backers have envisioned the 1996 Summer Olympics as the debut showcase for HDTV broadcasts in this country, the earliest time frame will more likely be 1997. NBC has announced it will begin HDTV broadcasts at that time.

You'll need a high-definition TV to take advantage of the greater resolution and 16x9 aspect ratio of HDTV. These sets will probably cost $3,000 or more when they first become available, but as with other consumer electronics products,

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prices will probably drop over time. All the major TV manufacturers have HDTV-capable sets in their labs and are expected to have sets available when broadcasts begin.

The FCC has stipulated that NTSC broadcasts, the current standard, will continue for 15 years from the time regular HDTV broadcasting begins.

Besides high-resolution TV broadcasts, other uses for HDTV are likely. HDTV is digital, and digital compression makes it possible to use the bandwidth for a variety of applications. For example, in the same 6MHz spectrum slice that one HDTV channel could occupy, six lesser-quality channels could be transmitted. Or the space could be used to broadcast computer data, video games, audio channels, paging services, and so on.

Originally, one point of contention between the computer industry and broadcasters over HDTV standards was whether sets should use a progressive or interlaced scan method. Progressive (or non-interlaced) scanning paints the screen image from top to bottom in one pass, as non-flicker computer monitors do. Conventional TV sets put the image on the screen in two passes, filling out alternating lines as in an interlaced signal. The Grand Alliance resolved the disagreement by designing the HDTV system to receive and display both signals. A converter was necessary, and, recently, a professor of electrical engineering at the Massachusetts Institute of Technology patented a device that will switch between the two transmission methods automatically.

Professor Jae Lim says the converter would enable sets to accept both types of signals. Present sets receive 525 lines. With the inclusion of Lim's circuit, HDTV sets will be able to receive either 720 progressive lines or 1,080 alternating lines (in two 540-line passes).

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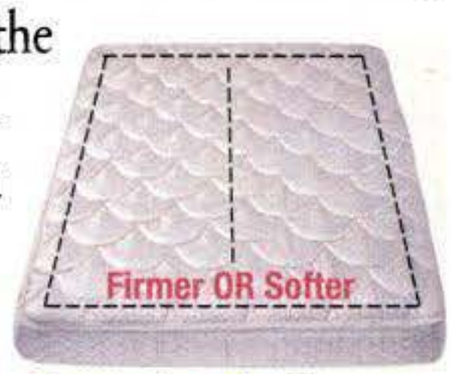

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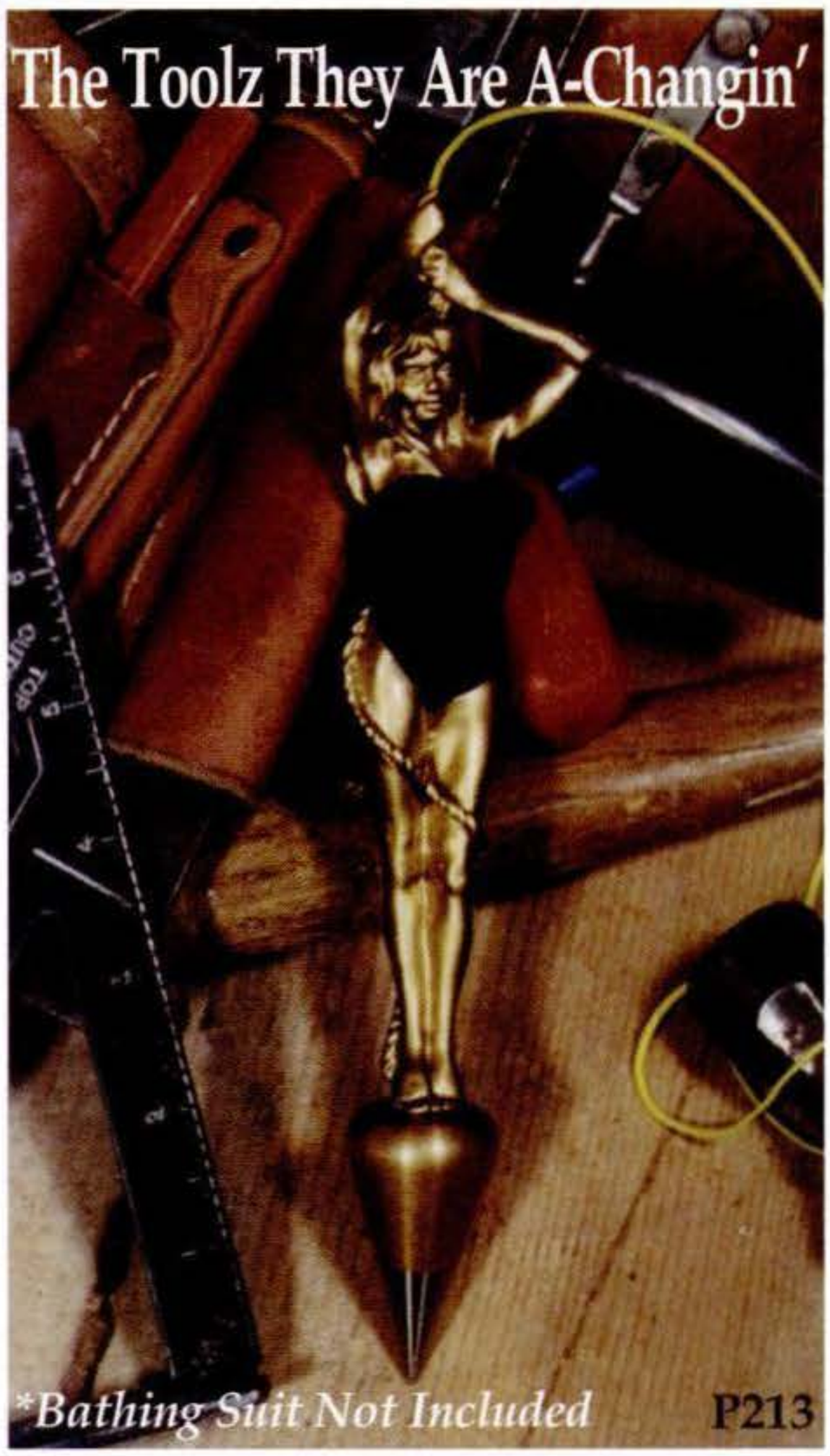

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Natural Prostate Relief

It's a natural fact. If you are a male over 40 and don't already suffer from a prostate gland disorder, the odds are 2 to 1 that you will before you are 59. By the age of 65, most American men have enlarged prostates.

As the years pass, mild discomforts can become disabling. Today, prostate surgery is the second most commonly performed surgery in men over age 65! Surgical complications can include total loss of bladder control and sexual dysfunction.

Prescription drugs may halt the swelling, but rarely end the suffering. Also, many prescription drugs may have side-effects, like weak erections and low sex drive.

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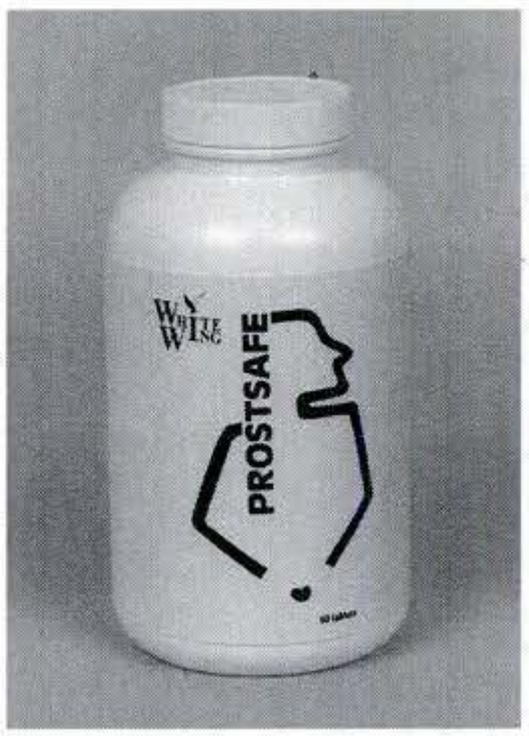

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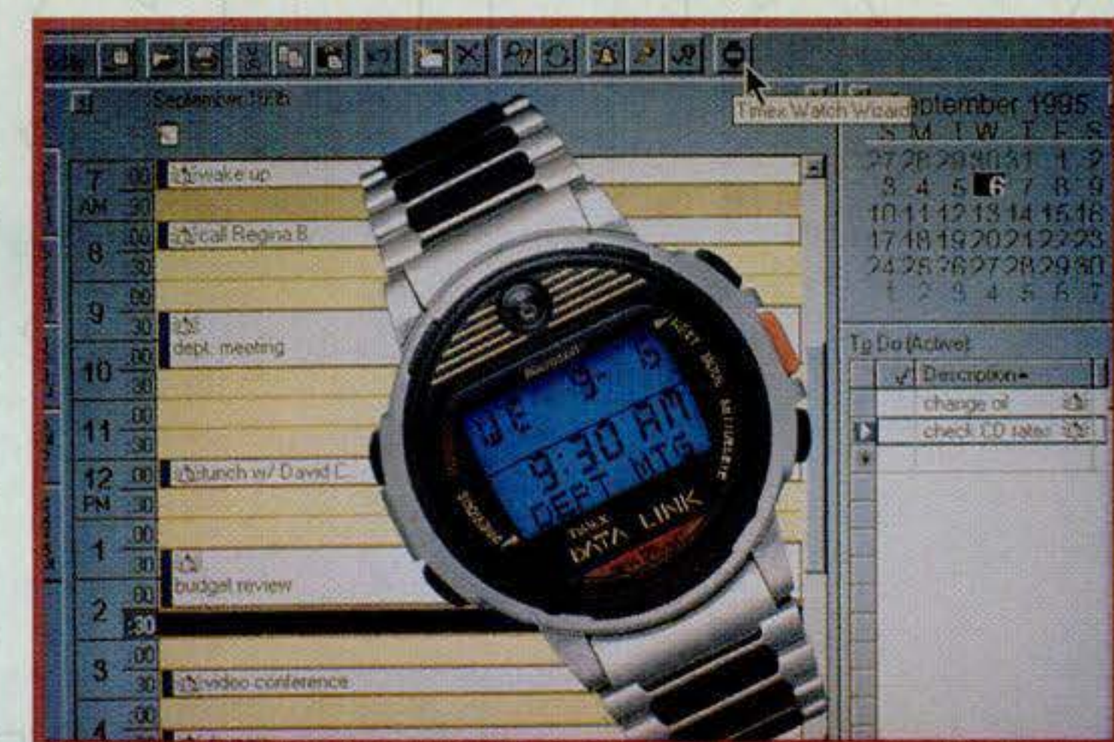

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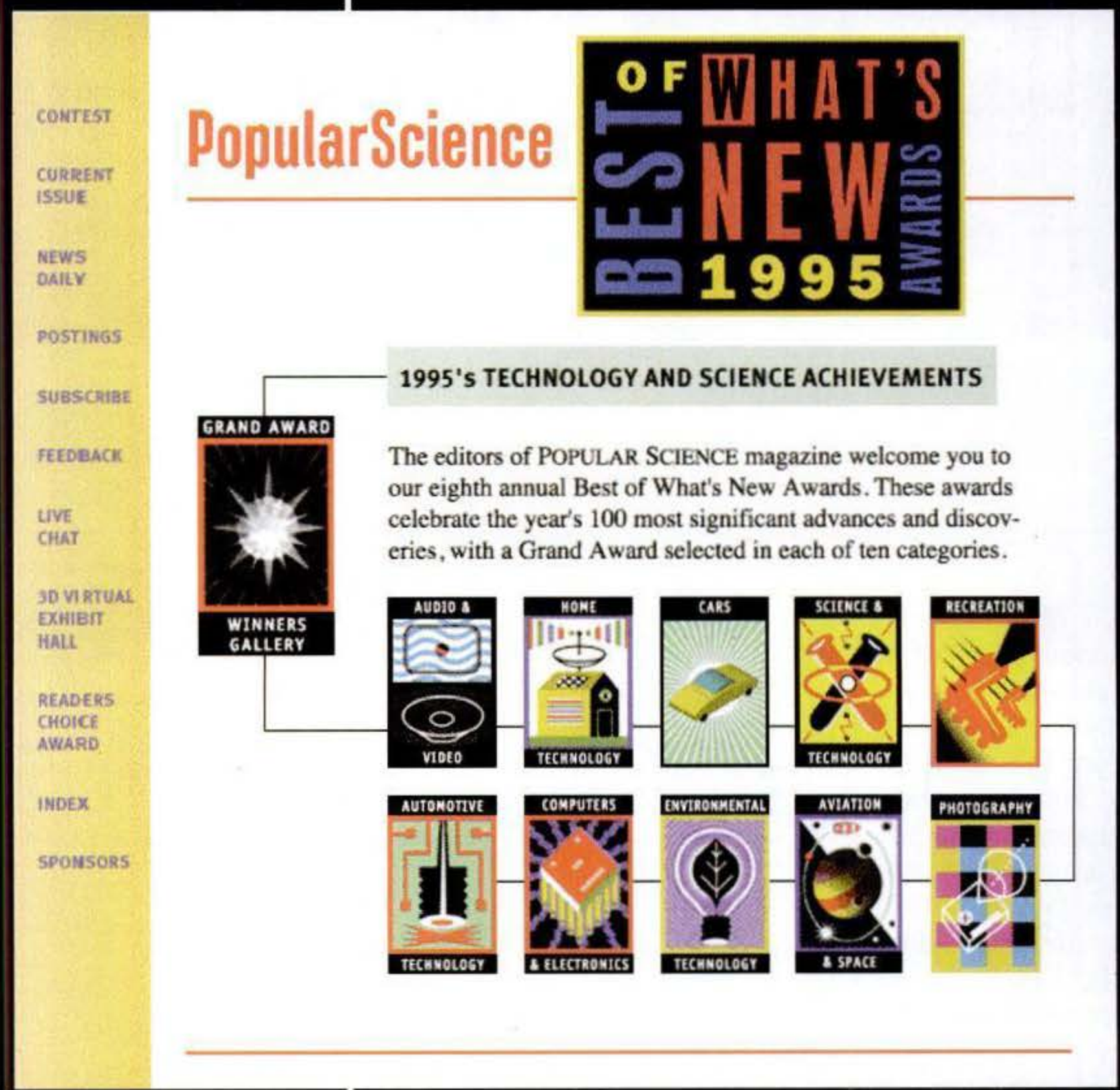

Best of What's New on the Web continues through the end of 1995 with a 3D Virtual Exhibit Hall of winners, plus photos and information on all participants. There are links to more information from the winners, Chat Rooms for your feedback, and a scavenger hunt where you follow the clues to win a prize. You can also vote for your favorite products and technologies in the Reader's Choice Award, which will be announced on January 2, 1996.

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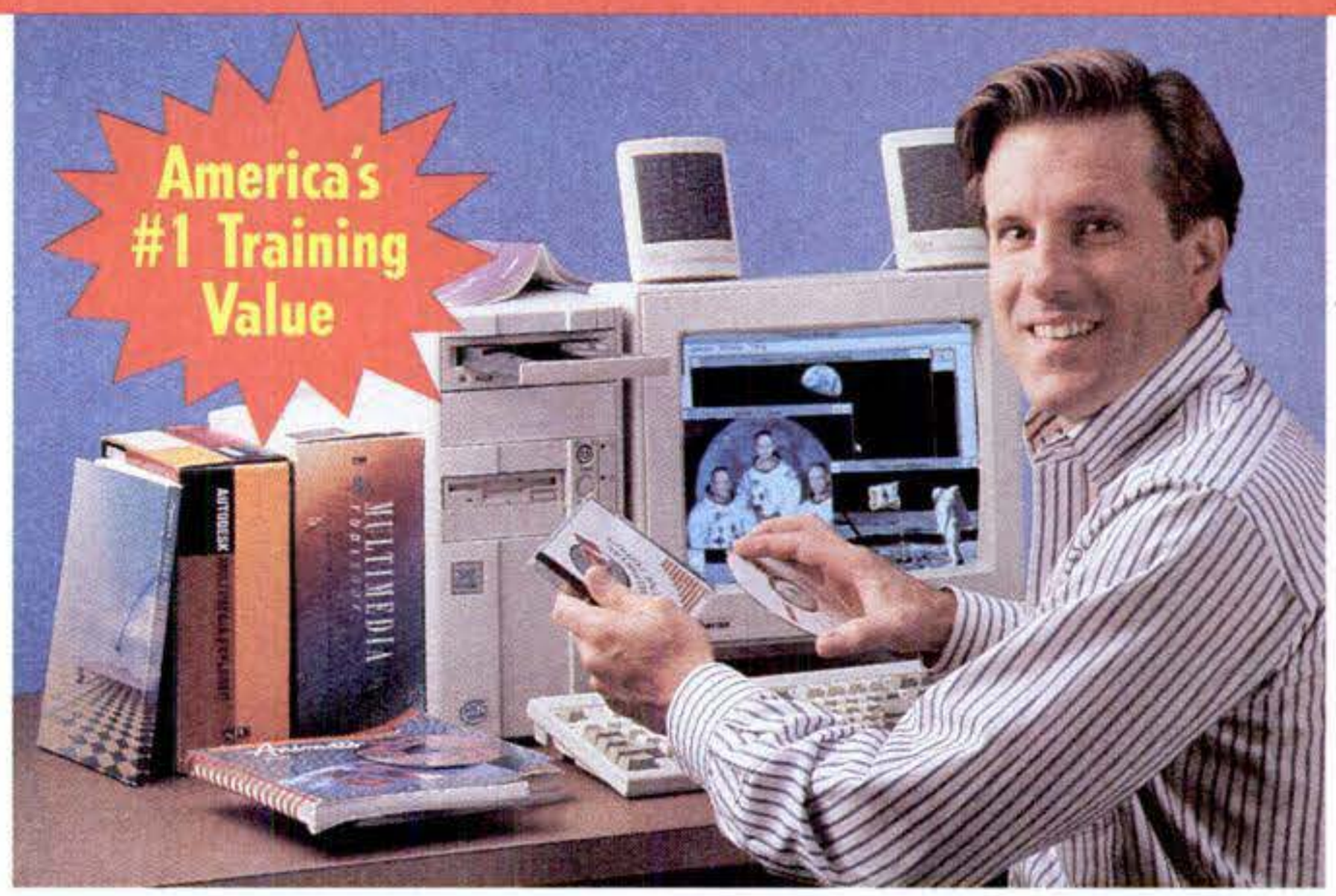

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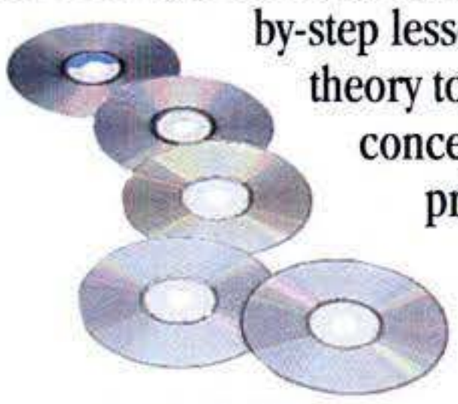

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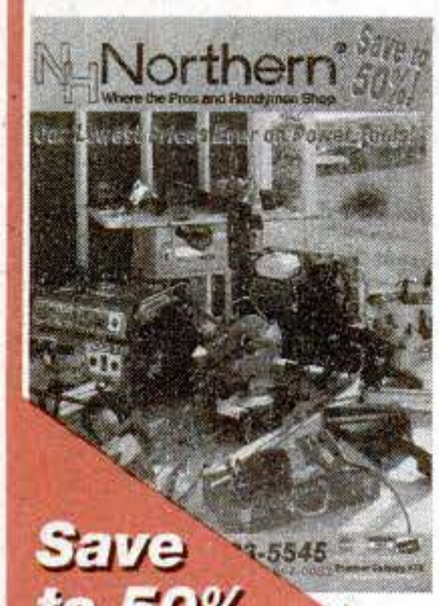

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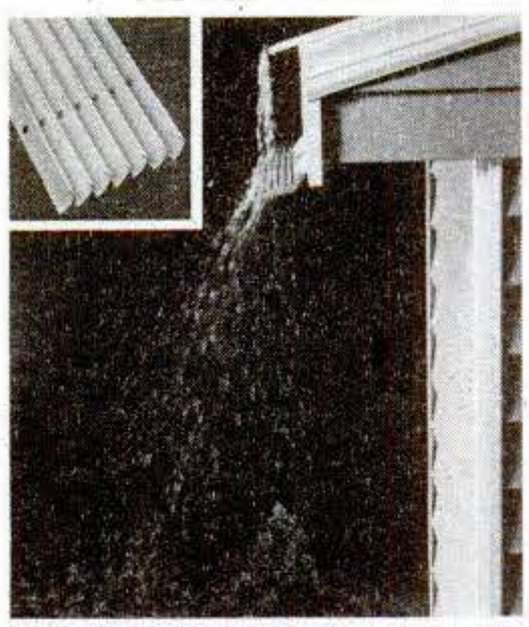

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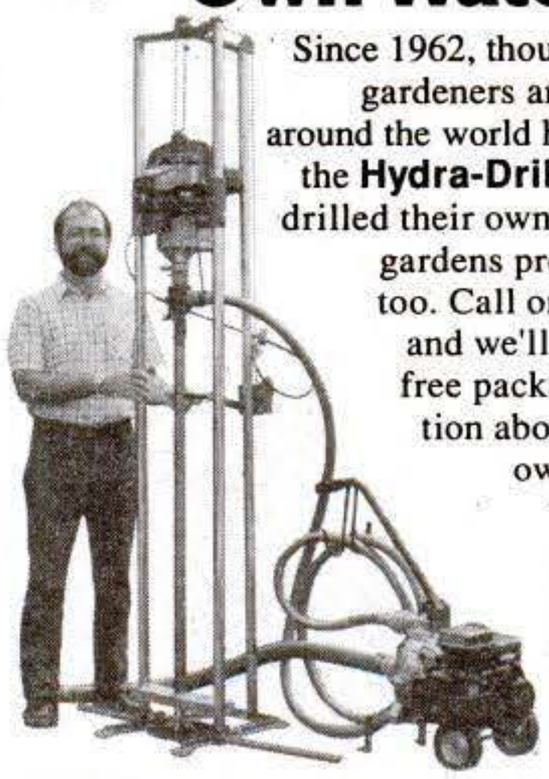

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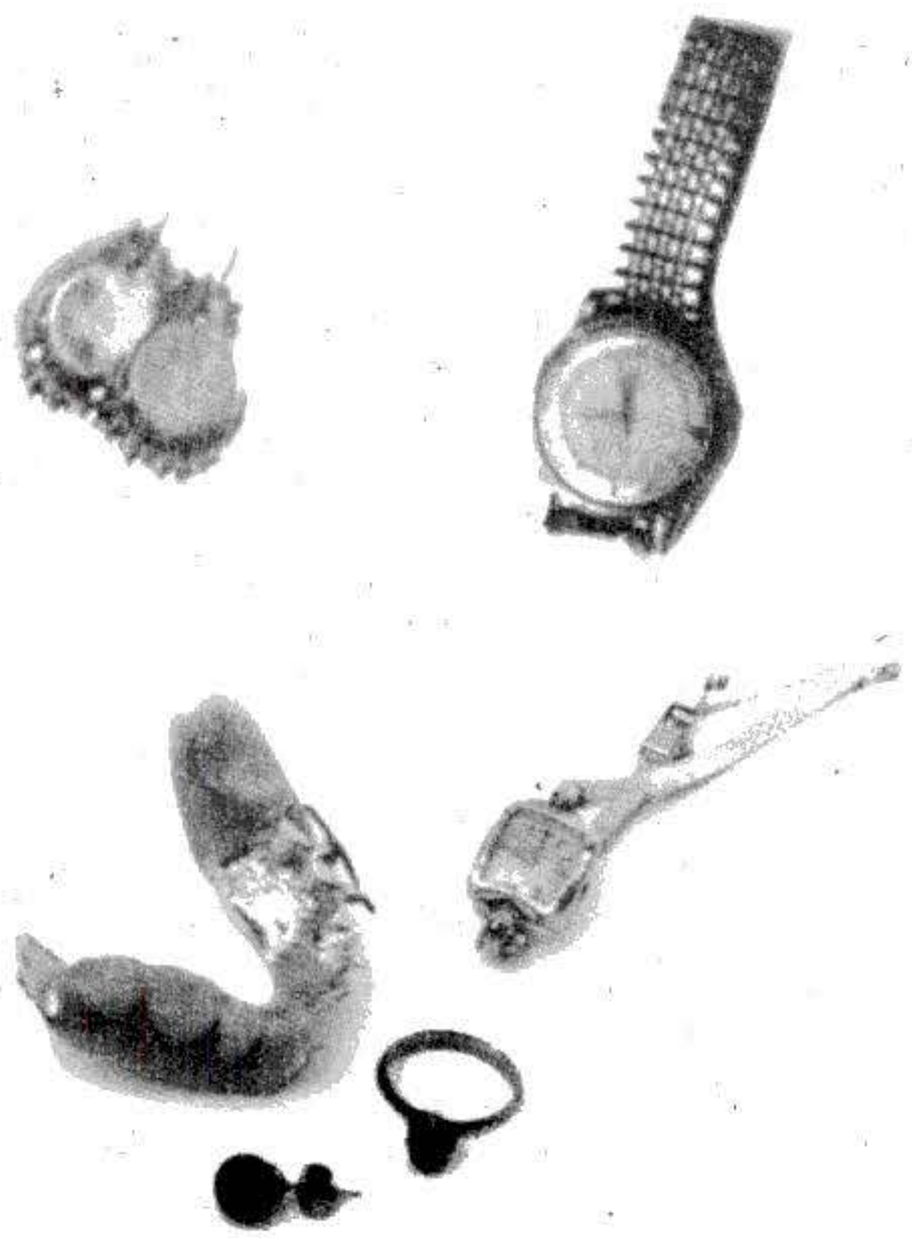

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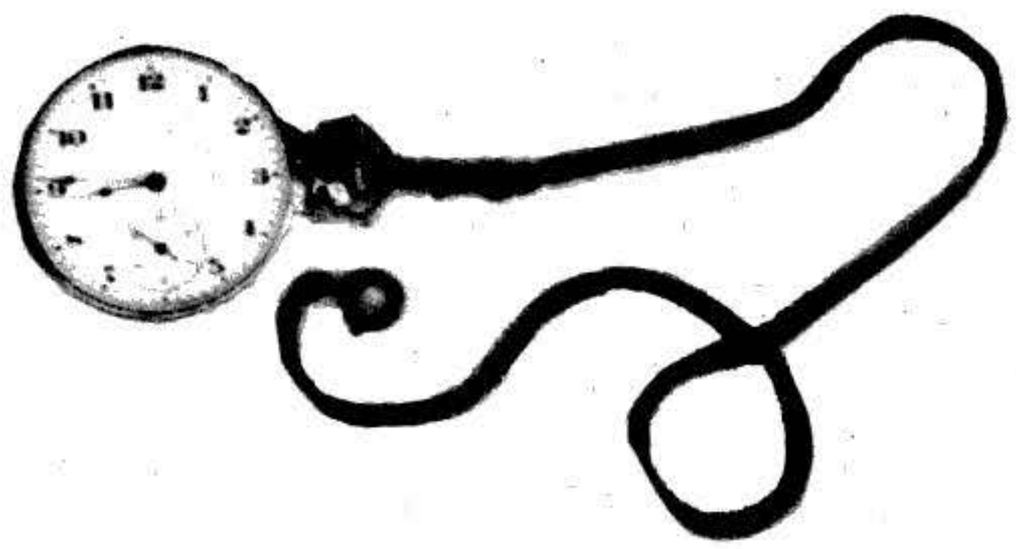

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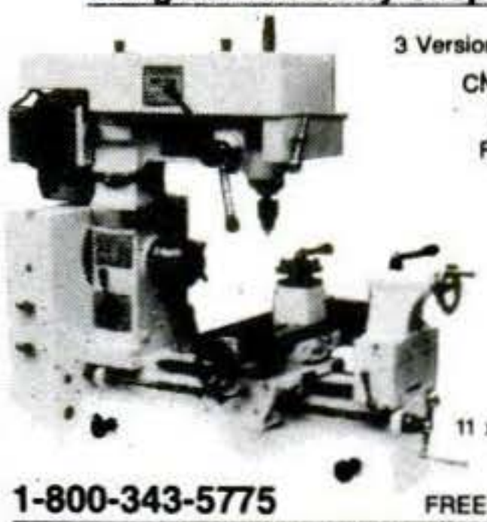

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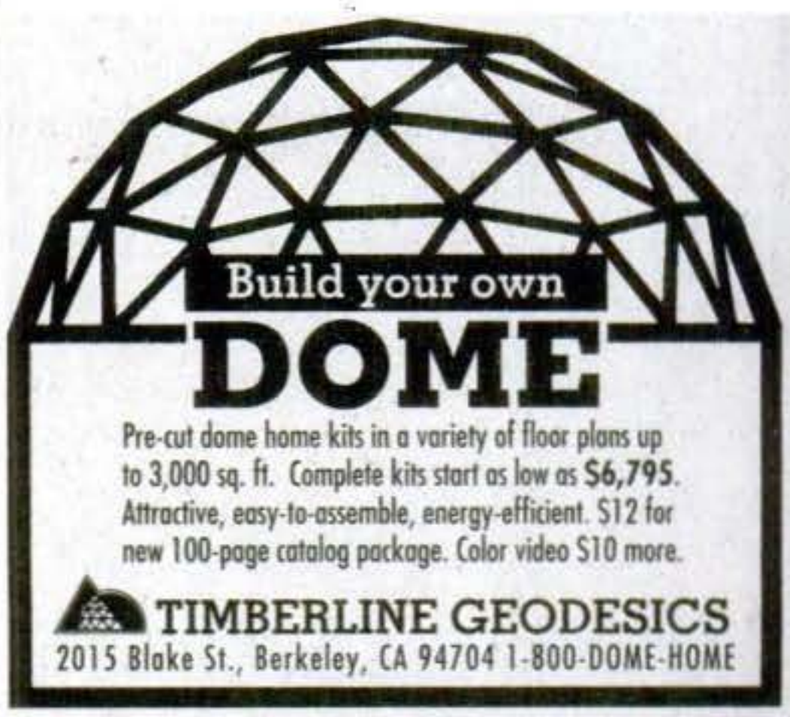

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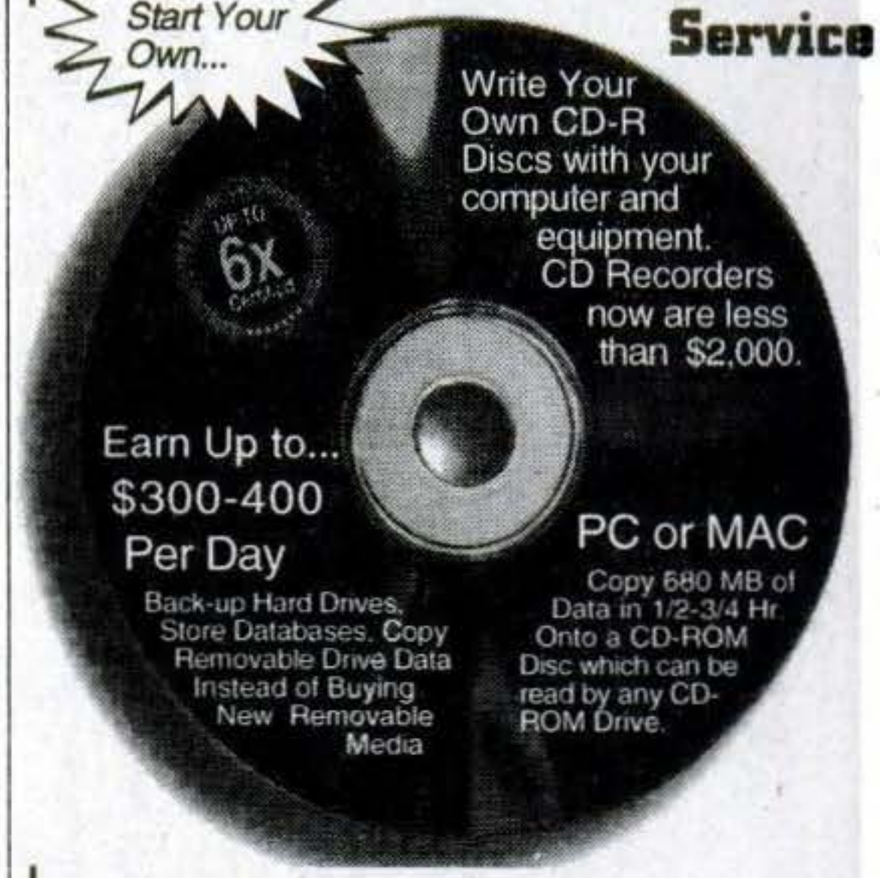

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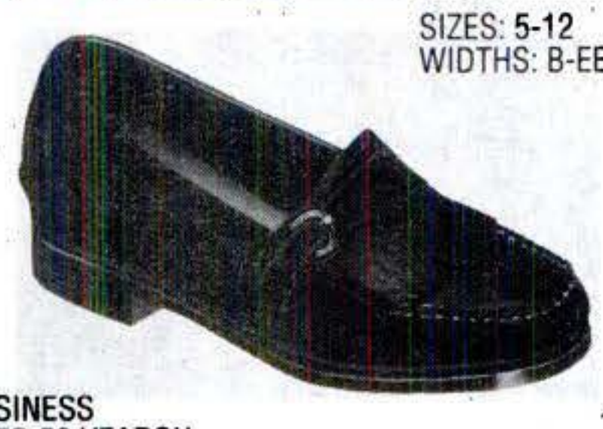

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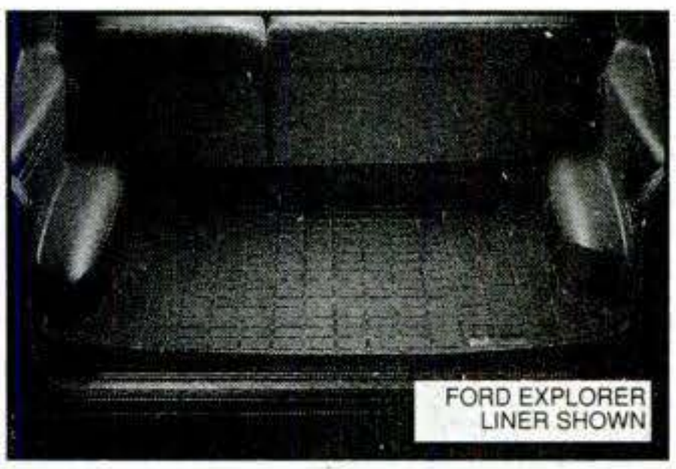

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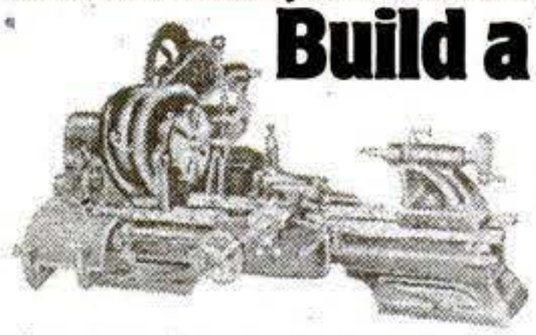

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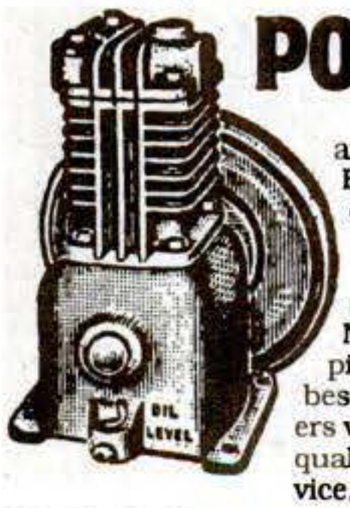

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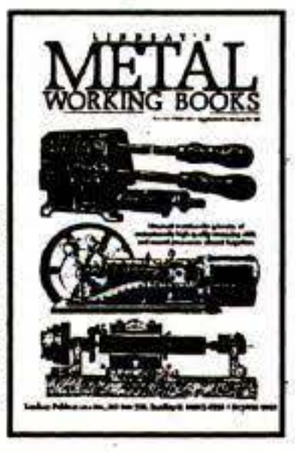

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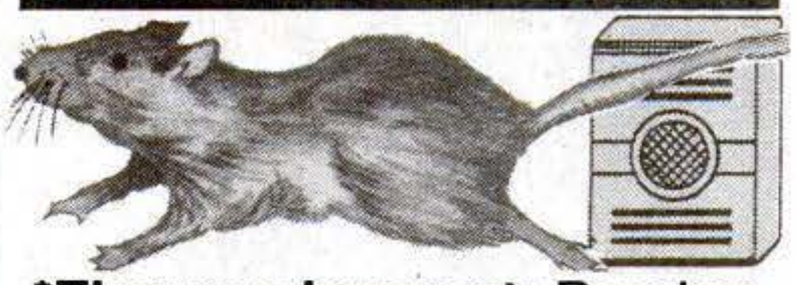

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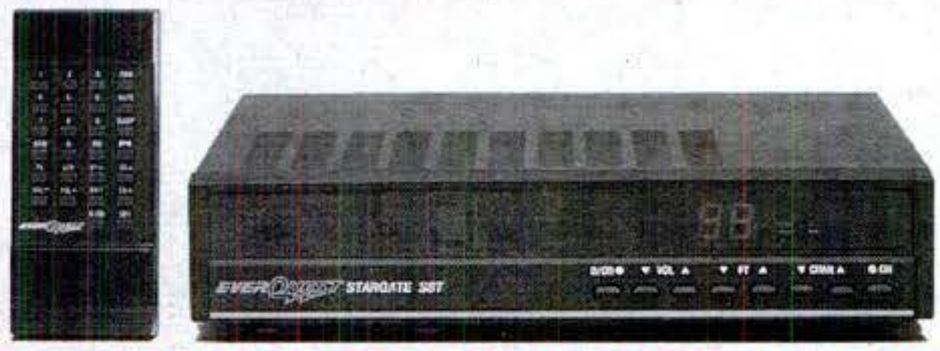

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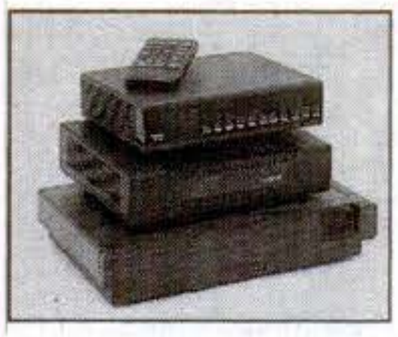

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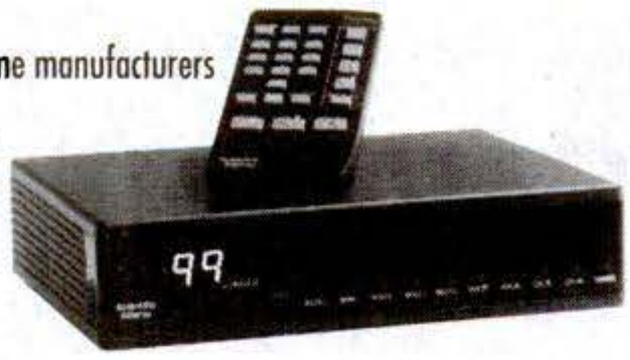

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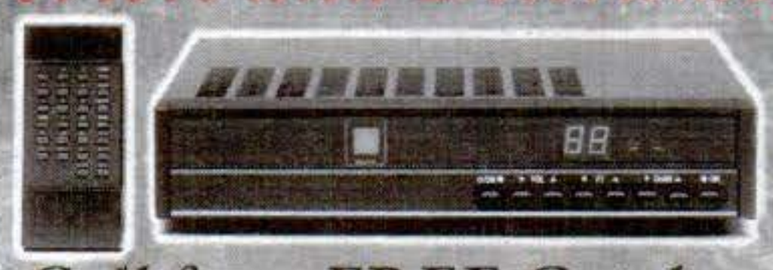

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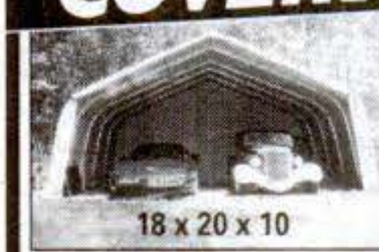

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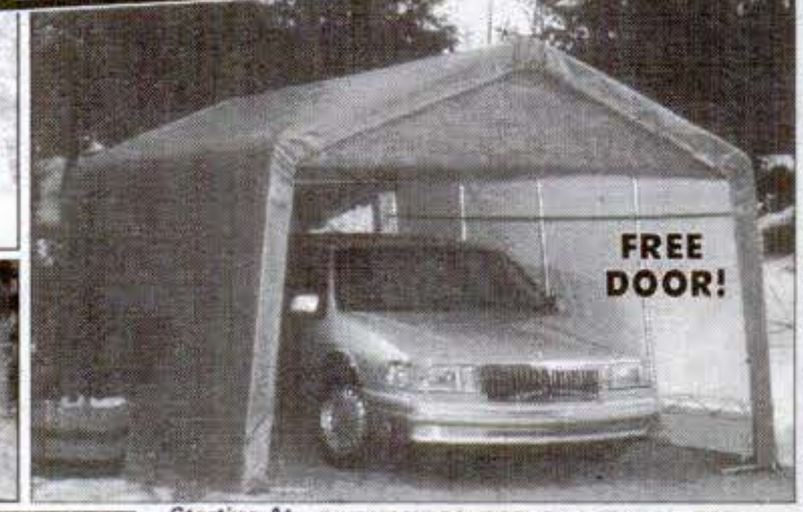

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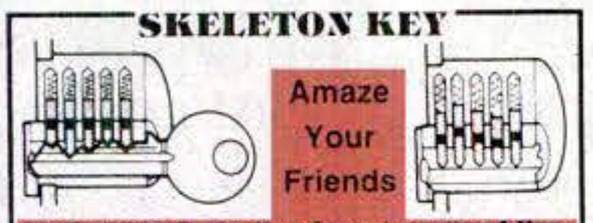

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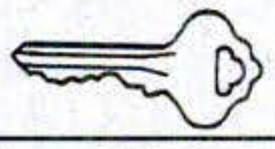

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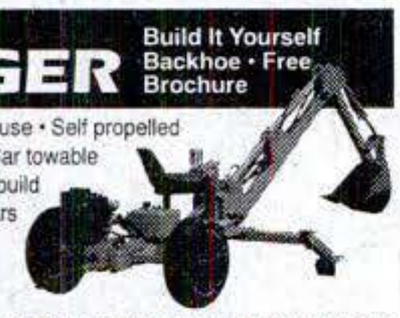

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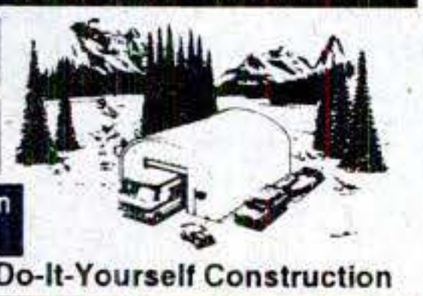

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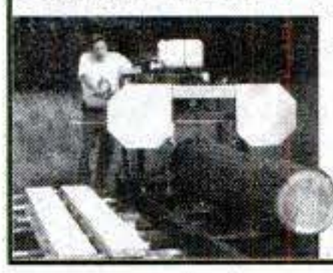

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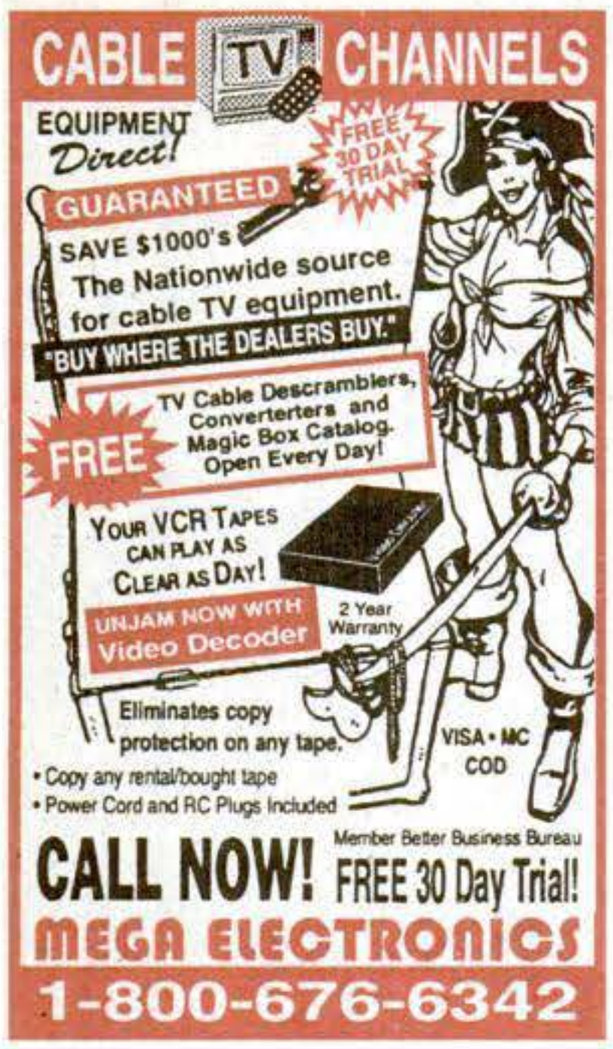

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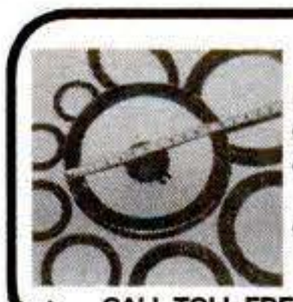

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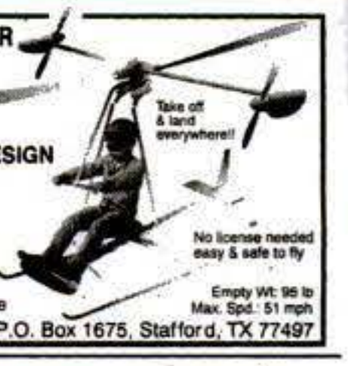

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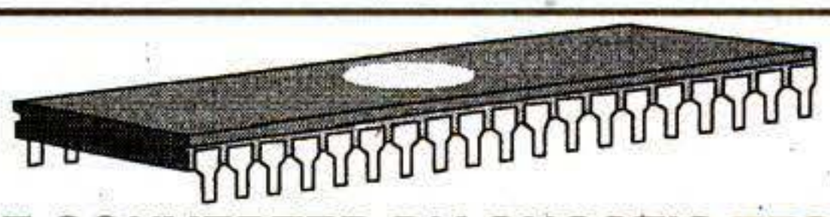

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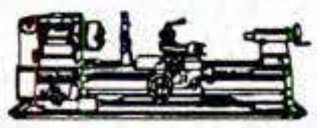

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Man's Arrival in America

100 YEARS AGO THE DOUBT concerning the sufficiency of evidence for the existence of man in America during the Glacial period is so great that special interest is being paid to the discovery of a chipped chert implement in a Glacial Age gravel pit in Ohio. The implement has the character of a knife that appeared at the very dawn of human development and goes a long way toward solving the mystery of man's antiquity on the western continent.—December 1895.

The date humans arrived in North America remains controversial. "Glacial Age" commonly refers to the Pleistocene Epoch, some 2,500,000 to 10,000 years ago. The prevailing belief is that early Americans migrated across a land bridge connecting Alaska and Siberia about 11,500 years ago. But some anthropologists have found remains indicating humans may have been here as early as 55,000 years ago.

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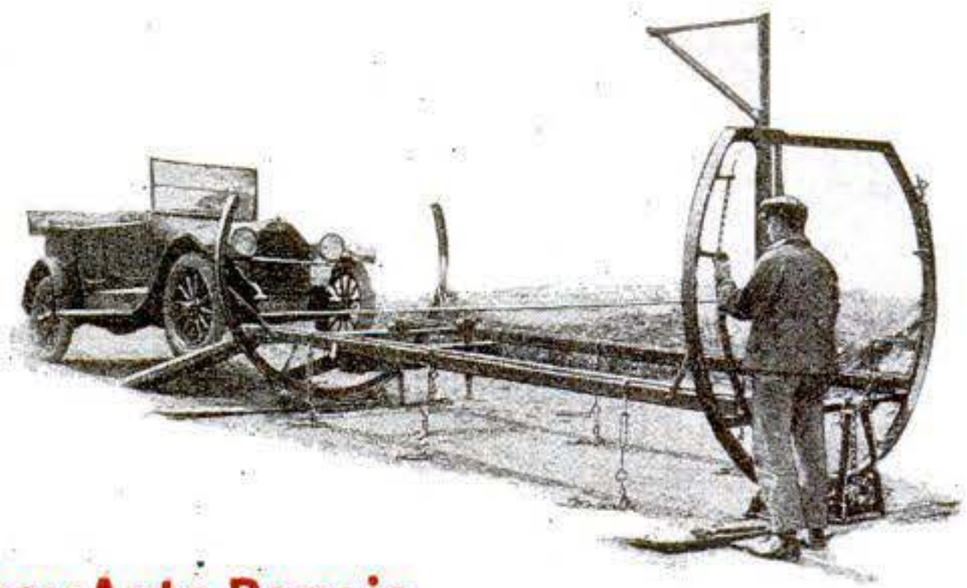

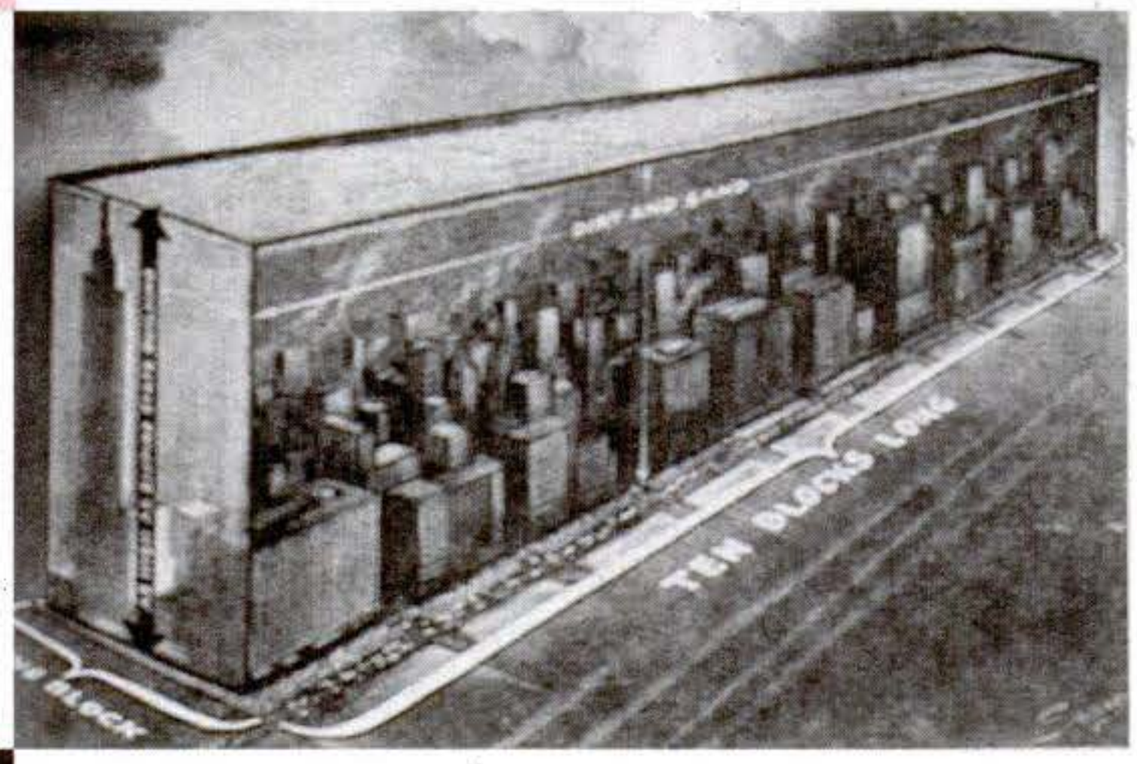

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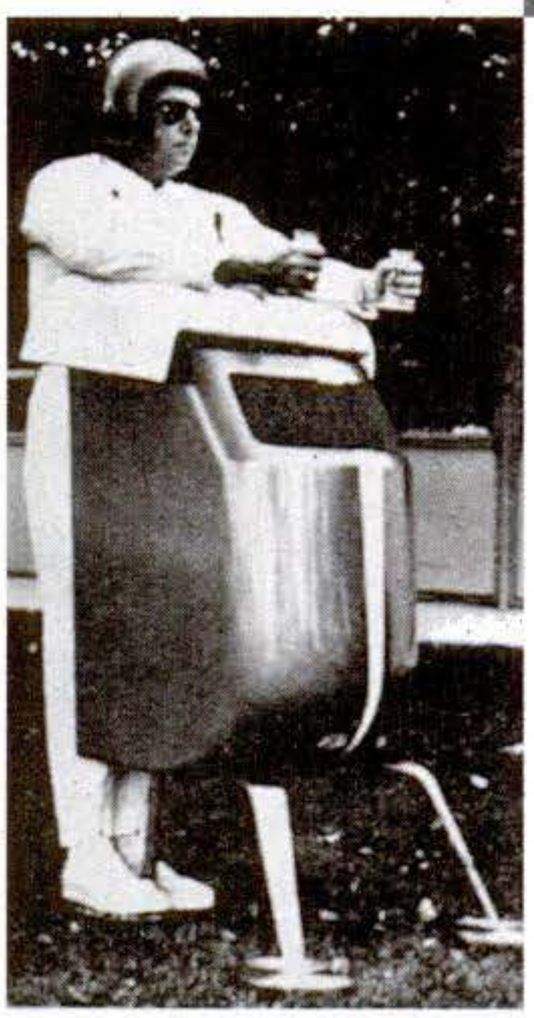

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25 YEARS AGO AN ADVANCED version of the flying jet belt will enable man to dart wasplike at more than 60 mph for 20 to 30 minutes. The turbine-powered craft incorporates the world's smallest fanjet engine. To fly the craft, the pilot simply walks up, steps on the platform, starts the turbine, grips the hand controls, and takes off.—*December 1970*

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